ENVIRONMENTAL ASSESSMENT

White-tailed Deer Damage Management in Ohio

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Animal and Plant Health Inspection Service
Wildlife Services

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ACRONYMS

ADC	Animal Damage Control
AMDUCA	Animal Medicinal Drug Use Clarification Act
APHIS	Animal and Plant Health Inspection Service
AVMA	American Veterinary Medical Association
CCC	Cultural Carrying Capacity
CDC	Center for Disease Control
CEQ	Council on Environmental Quality
CWD	Chronic Wasting Disease
DDM	Deer Damage Management
DEA	Drug Enforcement Administration
DMP	Deer Management Permits
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FEIS	Final Environmental Impact Statement
GnRH	GonaCon™
HME	Human monocytic ehrlichiosis
IWDM	Integrated Wildlife Damage Management
MBTA	Migratory Bird Treaty Act
MIS	Management Information Systems
MOU	Memorandums of Understanding
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NOA	Notice of Availability
NWRC	National Wildlife Research Center
ODA	Ohio Department of Agriculture
ODNR	Ohio Department of Natural Resources
ODW	Ohio Division of Wildlife
PZP	Porcine Zona Pellaida
SOP	Standard Operating Procedures
T&E	Threatened and Endangered (species)
USDA	United States Department of Agriculture
USDI	United States Department of Interior
USFWS	United States Fish and Wildlife Service
WDM	Wildlife Damage Management
WS	Wildlife Services (USDA, APHIS)

SUMMARY

This Environmental Assessment (EA) analyzes the potential environmental impacts of alternatives for United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), WS (WS) involvement in the reduction of conflicts with and damage by white-tailed deer (*Odocoileus virginianus*) in Ohio. The WS activities considered in this EA could be conducted at any site in Ohio where a need exists and where WS assistance is requested including private and public property.

Alternatives examined in the EA include an alternative in which WS does not become involved in deer damage management; an alternative in which WS is restricted to the use and recommendation of only non-lethal deer damage management (DDM) methods; and an alternative in which WS provides technical assistance (recommendations) but does not provide operational assistance with implementing the recommendations (Chapter 3). The first alternative considered, the preferred alternative, is for WS to continue to implement an Integrated Deer Damage Management Program that includes the use of the full range of legal non-lethal and lethal DDM techniques. WS would use an integrated wildlife damage management approach to apply these techniques, singly or in combination, to meet requester needs for reducing conflicts with white-tailed deer. Cooperators requesting assistance would be provided with recommendations and information regarding the use of effective non-lethal and lethal techniques. Non-lethal methods recommended and used by WS may include resource management, physical exclusion, relocation, human behavior modification, frightening devices, and other deterrents (Appendix B). Lethal methods recommended and used by WS may include live capture and euthanasia, and/or shooting (Appendix B). Where appropriate, in situations where deer damage problems are attributable to high deer densities, WS may recommend that property owners/managers work with the Ohio Division of Wildlife to resolve their problem through the use of licensed hunting. All WS activities would continue to be conducted in accordance with applicable state, federal and local laws and regulations.

The EA provides a detailed analysis of the impacts of each alternative on the white-tailed deer population; non-target species including vegetation and state and federally-listed threatened and endangered species; public health and safety; humaneness of the alternatives used; and the positive and negative aesthetic impacts of deer; sociological concerns including aesthetic values; and licensed deer hunting opportunities.

CHAPTER 1: PURPOSE OF AND NEED FOR ACTION

1.1 Introduction

Within Ohio and across the United States, wildlife habitat has been substantially changed as human populations expand and land is used for human needs. These human uses and needs often compete with those of wildlife which increases the potential for adverse human/wildlife interactions. Some members of the public desire protection for all wildlife. This protection can increase local wildlife populations which may result in new, or complicate existing, wildlife damage problems. The *Animal Damage Control Programmatic Final Environmental Impact Statement* (EIS) summarizes the relationship in American culture of wildlife values and wildlife damage in this way (United States Department of Agriculture (USDA 1997 Revised) :

> "*Wildlife has either positive or negative values, depending on varying human perspectives and circumstances . . . Wildlife is generally regarded as providing economic, recreational and aesthetic benefits . . . and the mere knowledge that wildlife exists is a positive benefit to many people. However . . . the activities of some wildlife may result in economic losses to agriculture and damage to property . . . Sensitivity to varying perspectives and value is required to manage the balance between human and wildlife needs. In addressing conflicts, wildlife managers must consider not only the needs of those directly affected by wildlife damage but a range of environmental, sociocultural and economic considerations as well*."

Wildlife damage management (WDM) is the science of reducing damage or other problems caused by wildlife, and is recognized as an integral part of wildlife management (The Wildlife Society 1992). The USDA, Animal and Plant Health Inspection Service (APHIS), Wildlife Services (WS) is the federal agency authorized to protect American resources from damage associated with wildlife (Act of March 2, 1931 (46 Stat. 1468; 7 U.S.C. 426-426b) as amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 U.S.C. 426c). Wildlife Services' mission, developed through its strategic planning process, is: 1) *"to provide leadership in wildlife damage management in the protection of America's agricultural, industrial and natural resources, and 2) to safeguard public health and safety."* Wildlife Services's Policy Manual reflects this mission and provides guidance for engaging in WDM through:

* training of WDM professionals;
* development and improvement of strategies to reduce losses and threats to humans from wildlife;
* collection, evaluation, and dissemination of management information;
* informing and educating the public on how to reduce wildlife damage; and
* providing data and a source for limited-use management materials and equipment, including pesticides (USDA 1999).

WS is a cooperatively funded, service-oriented program from which other governmental agencies and private entities may request assistance with WDM. WS cooperates with land and wildlife management agencies to reduce wildlife damage effectively and efficiently according to applicable federal, state and local laws; and Memorandums of Understanding (MOUs) between WS and other agencies.

This environmental assessment (EA) analyzes the potential environmental effects of alternatives for managing white-tailed deer (*Odocoileus virginianus*) damage to agriculture, property, natural resources, and human health and safety in Ohio. The analysis relies mainly on existing data contained in published documents (Appendix A), including the *Animal Damage Control Program Final Environmental Impact Statement* (USDA 1997 Revised). The Ohio Department of Natural Resources (ODNR), Division of Wildlife (ODW) and the Cuyahoga Valley National Park were consulting agencies in the preparation of the EA and provided valuable information for the analysis. Management of resident wildlife species is the responsibility of the ODW. The ODW collects and compiles information on white-tailed deer population trends, deer taken, and deer damage complaints, and uses this information to manage deer populations. The Cuyahoga Valley National Park is developing a plan and associated EIS to manage white-tailed deer and deer damage to natural resources in the park. Information from their project has also been included in this EA.

WS uses an Integrated Wildlife Damage Management (IWDM) approach, known as Integrated Pest Management (WS Directive 2.1051), in which a combination of methods may be used or recommended to reduce wildlife damage. IWDM is described in Chapter 1:1-7 of USDA (1997 Revised). These methods may include but are not limited to alteration of cultural practices, and habitat and behavioral modification and repellents to prevent or reduce damage. The reduction of wildlife damage may require that individual animals be removed or the local populations of offending animal(s) be reduced through lethal means. Wildlife Services' WDM activities are not based on punishing offending animals but are one means of reducing damage used as part of the WS Decision Model (Slate et al. 1992). The need for action is derived from the specific threats to resources or the public. Wildlife Service's vision is to improve the coexistence of people and wildlife, and its mission is to provide Federal leadership in managing problems caused by wildlife. The imminent threat of damage or loss of resources is often sufficient for individual actions to be initiated.

Normally, according to the APHIS procedures implementing the National Environmental Policy Act (NEPA), individual WDM actions may be categorically excluded (7 CFR 372.5(c), 60 Fed. Reg. 6,000- 6,003, (1995)). Wildlife Services has decided in this case to prepare this EA to facilitate planning, interagency coordination, and the streamlining of program management, and to clearly communicate with the public the analysis of individual and cumulative impacts. In addition, this EA has been prepared to evaluate

1 WS Policy Manual - Provides guidance for WS personnel to conduct wildlife damage management activities through Program Directives. WS Directives referenced in this EA can be found in the manual but will not be referenced in the Literature Cited Appendix.

and determine if there are any potentially significant or cumulative impacts from the deer damage management (DDM) alternatives. All WDM that would take place in Ohio would be undertaken in accordance with relevant laws and regulations including the Endangered Species Act (ESA).

1.2 Purpose

The purpose of this EA is to address and evaluate the potential impacts to the human environment from alternatives for WS involvement in white-tailed deer (deer) damage management in Ohio. The proposed program is intended to reduce damage and conflicts associated with white-tailed deer impacts on agricultural resources, urban/suburban landscaping, property, natural resources, deer-vehicle and deer-aircraft collisions; risks to human health and safety; and concerns about the spread of disease among wildlife and livestock. The DDM activities proposed in this EA could be conducted on private, federal, state, tribal, county, and municipal lands in the state of Ohio where a need exists, a request for assistance is received and resources are available.

1.3 Background

1.3.1 History of White-tailed Deer Management in Ohio

There is evidence of white-tailed deer in Ohio since the end of the last ice age when they were found in the unglaciated southeastern portion of the state. As the ice age ended, the white-tailed deer spread across Ohio. Native Americans, wolves and cougars likely limited the deer population slightly, but the deer population prior to 1775 appears to have been healthy and stable. Deer were an important resource to Ohio's prehistoric Native American cultures. The first European settlers in Ohio also hunted white-tailed deer for meat and hides to provide them with food and clothing (http://www.ohiohistorycentral.org/entry.php?rec=1886).

As the Europeans moved into Ohio they carved farms out of Ohio's forests. Unrestricted hunting and loss of cover and food resulted in decreases in the deer population. Ohio's government established the first hunting restrictions in 1857. However hunting seasons lasted over a month with no bag limits. From 1897 to 1899 there were no hunting seasons in Ohio (http://www.ohiohistorycentral.org/entry.php?rec=1886). By 1904 the white-tailed deer no longer existed in Ohio (Tonkovich 2005).

During 1922-1930 a restocking program began with a Division of Conservation (predecessor to the ODW) purchase of at least 200 deer from private individuals to stock an 800 acre corral in Scioto County. In 1932 the gates where opened and these deer joined deer from the natural immigrants from of surrounding states. By 1937 deer were reported in 28 of Ohio's 88 counties. Regulated hunting seasons

returned in select counties in 1943. By 1968 the white-tailed occurred in all 88 of Ohio's counties. Rapid population growth occurred in 1970's and 1980's due to restricted harvests and habitat improvements. Currently it estimated that there are 675,000 deer in Ohio. The ODW's official deer management goal is to maintain county deer populations at a level that provides maximum recreational opportunity including hunting, viewing, and photography, while minimizing conflicts with agriculture, motor travel, and other human activities. Each year wildlife biologists evaluate deer herd population numbers and establish appropriate hunting season dates and bag limits for white-tailed deer (http://www.dnr.state.oh.us/Portals/9/pdf/WildOhioWINTER2006.pdf).

Since white-tailed deer thrive in habitat that is composed of a mix of woods and clearings, the expansion of housing developments into forests or onto farms provides excellent white-tailed deer habitat. Parks, industrial and home sites created in a wooded area may produce habitat preferred by white-tailed deer. Open farm fields become better deer habitat as new homeowners' plant trees and shrubs on their bare home site. Deer populations have escalated in these suburban landscapes where exceptional habitat is available and hunting may be restricted or prohibited by local ordinances. In these situations the only significant cause of mortality is automobiles. In 1994, in response to increasing numbers of deer-vehicle accidents and low harvests in urban/suburban areas, ODW established and still maintains, 5 urban deer hunting zones. Where local ordinances permit, hunters may harvest additional antlerless deer within the Urban Deer Zones (http://www.dnr.state.oh.us/Portals/9/pdf/WildOhioWINTER2006.pdf).

To date, WS involvement in DDM in Ohio has been extremely limited and has consisted of deer hazard management at airports which was addressed in the EA, *Wildlife Hazard Management at Airports in Ohio* (USDA 2007). WS has also live-captured and relocated a deer caught in a dangerous spot on a frozen lake, and euthanized deer injured by non-WS entities (e.g., vehicle collisions).

1.3.2 Ecology, Behavior and Population Status

The white-tailed deer is one of the most ubiquitous and well-known wild animals in Ohio, and its large population has a huge effect on other kinds of wildlife and on the natural environment as a whole (Fergus 2000). In Ohio, the adult male (buck) weighs 130-300 pounds. The adult female (doe) ranges from 90-210 pounds. The adult body length of a deer in Ohio ranges from 52-95 inches (http://www.dnr.state.oh.us/BuckeyeBigBuckClub/tabid/18773/Default.aspx). Deer weights vary considerably, depending on age, sex, diet, and season of the year (Fergus 2000).

Male deer have antlers that are made of bone and are connected to the skull. Antlers begin developing in March or April. They are covered by a layer of skin, the velvet, richly supplied with nutrient-carrying blood vessels. In August or early September, antler growth stops, the velvet is shed, and the buck carries his antlers throughout the fall breeding season. As the buck's testosterone levels

dwindle, a separation layer forms between the antlers and skull. In January or February the antlers fall off and the buck grows new antlers each year (Fergus 2000). Antler growth is based on several factors; genetics, age of the deer, and food quantity and quality. Typically, bucks with larger antlers are more pleasing to the public for aesthetic reasons and for recreational (harvest) purposes.

Deer are strictly plant eaters and eat leaves and twigs from a vast assortment of woody plants, including aspen, ash, beech, birch, dogwood, maple, oak, willow, witch hazel, pine, and hemlock (Fergus 2000). Deer eat garden vegetables, wild mushrooms, fruits such as apples and pears, and crops, including soybeans, corn, and alfalfa. Acorns are a favorite food, and deer consume them in great quantities when putting on fat for winter. A deer will eat 5 to 9 pounds of food daily (Fergus 2000). Typical foods in Ohio include wild crabapple, corn, sumac leaves and stems, grasses, clover leaves, jewelweed leaves, acorns, and dogwood fruits and stems.

Deer breed from October to January. Peak breeding activity occurs in early to mid- November, and most adult females have been bred by the end of December. Most does bear their fawns from late May to early June, after approximately two hundred days of gestation. Year-old does may have one fawn, and older does generally have twins and, sometimes, triplets. Fawns weigh 4 to 8 pounds at birth. They nurse almost immediately and can walk within an hour (Fergus 2000).

Ideal white-tailed deer habitat consists of brush-stage forest with a wide variety of tree and plant species. However, white-tailed deer are highly adaptable and live in many habitats, including woodlots in farming country, suburbs, and deep woods. Deer live out their entire lives in the same home range, about 40 acres in good habitat to over 300 acres in marginal habitat. Mature bucks usually have larger home ranges than those of does and younger deer (Fergus 2000).

The biological carrying capacity of a wildlife population is defined as the maximum number of animals that an areas native and human cultivated resources can support without degradation to the animal's health and the environment over an extended period of time. When this number is exceeded, the health of the population begins to suffer, reproduction declines, parasitism and disease increase, and habitat quality and diversity decrease due to overbrowsing of plant species preferred as food by deer (Kroll et al. 1986). Overbrowsing negatively impacts the habitat and landscape, and overall animal health declines due to less nutritious food items being available.

The cultural carrying capacity (CCC) is defined as the maximum density of a given species that can coexist compatibly with the local human population (Decker and Purdy 1988). This term is useful because it defines when conflicts with deer have exceeded an acceptable level, and provides managers with a target for establishing management objectives. For any given damage situation, there will be varying acceptance thresholds by those directly, as well as indirectly,

affected by the damage. Factors which may influence the CCC include landscape or vegetation impacts, crop damage, threats to public safety, the potential for illegal killing of deer, and personal attitudes and values. The threshold of wildlife damage acceptance is a primary limiting factor in determining the CCC.

1.3.3 Licensed Deer Harvest in Ohio

White-tail deer hunting is an important tool for managing deer in Ohio and has high recreational and traditional value for many Ohio residents. In 2006, hunters purchased 543,614 deer permits and harvested 237,316 white-tail deer. Deer permits generated $9,299,092 for state wildlife management in 2006 (ODW, 2007). Prior to purchasing a deer permit/s most hunters are also required to purchase a regular hunting license. In 2006, the state ODW collected $9,218,441 in hunting license fees for wildlife management in the state. Deer hunting accounted for 32% of the ODW's Revenue in 2006, which contributes to management of all Ohio wildlife species (http://www.dnr.state.oh.us/Portals/9/pdf/WildOhioWINTER2006.pdf). Nationally, Ohio ranks among the top 10 states in hunting related purchases and in associated economic benefits (e.g., jobs created, sales taxes, income taxes from jobs created). In a 2001 study, Ohio deer hunters spent over $399 million and contributed with a total multiplier effect of over $861 million (Southwick Associates, Inc. 2002).

The regulations currently divide the state of Ohio into three hunting zones. Each zone has separate harvest regulations based on the current population of deer. Prior seasons' hunter harvest, vehicle collisions, crop damage complaints and other data is used to assist in determining the number of deer that may be taken in each zone. Harvest levels are reevaluated annually.

Although conventional hunting assists with much of the deer management in Ohio, damage to crops, ornamentals, and gardens still occurs. When damage does occur property owners can file a deer damage investigation report. Once these are filed the wildlife officer will investigate a site and can issue deer damage control permits (http://www.dnr.state.oh.us/Education/wilddeerherd/bullard/tabid/9555/Default.aspx). There are two types of deer damage control permits, an out-of-season and an in-season permit. Out-of-season permits allow property owners to remove deer during periods when standard deer hunting is not permitted. In many cases, these types of permits are issued to municipalities, urban landowners, and/or producers with severe damage problems. In season permits, allows producers or homeowners with damage to remove deer themselves or offer additional hunting opportunities to others during the regular hunting season. However, in 2007 in-season permits will no longer be offered by the ODW and only out-of -season permits will be issued for landowners experiencing deer damage.

1.4 Need for Action

1.4.1 Deer Damage to Agriculture

Deer damage to agricultural crops can have a substantial negative economic impact on individual farm operators. Deer damage a broad variety of vegetables, row crops, fruit, nursery stock, stacked hay, and ornamentals. In Ohio, most instances of deer damage to crops are handled by the ODW which may issue crop depredation permits. From 2001-2006, the ODW received an annual average of 1,700 complaints (range 965-2,221 complaints/year) regarding deer damage to crops. In response to these complaints the ODW issued an annual average of 1,619 deer damage control permits (1,091-2,149 permits/year) to landowners to help address damage problems (ODW 2007).

Little current data is available quantifying deer damage to crops in Ohio, however other data is available from adjacent states. An Indiana study by Humberg et al. (2004), indicated that soybeans were the principal crop damaged (36 percent of complaints), followed by corn (30 percent). Wildlife damage was found in 149 of the 160 fields surveyed. Raccoons and white-tailed deer were responsible for >97% of the damage to corn (87% and 10%, respectively), whereas white-tailed deer (61%) and groundhogs (*Marmota monax*; 38%) were responsible for nearly all damage to soybean plants (Humberg et al. 2004). The estimated economic loss from deer depredation to high-value agricultural crops for 1995 in Pennsylvania was $17,506,294 (Drake et. al 2003). High-value agricultural crops included fresh market and processed vegetables, including but not limited to snap beans, sweet corn, leafy vegetables, tomatoes, and peppers. Apples and peaches were also included as high-value crops (Drake et. al 2003). The estimated economic loss from deer depredation to grain crops for 1995-1996 in Pennsylvania was $25,738,984 (Drake et. al 2003). Grain crops included corn (silage and grain), soybeans, wheat, and oats (Drake et. al 2003).

1.4.2 Deer-Vehicle Collisions

Deer-vehicle collisions are a serious concern nationwide because of losses to property and the potential for human injury and death (Conover 1997, Conover et al. 1995, Romin and Bissonette 1996). The economic costs associated with deer-vehicle collisions include vehicle repairs, human injuries and fatalities, and picking up and disposing of deer (Drake et. al 2003). Conover et. al (1995) estimated that more than 1 million deer-vehicle collisions occur annually in the United States, costing over $1.1 billion in repair costs, and resulting in 29,000 human injuries and 211 human fatalities. Ohio state Highway Patrol recorded 28,240 deer-vehicle collisions in 2006 including 12 fatalities and 1,024 injuries (Ohio Insurance Institute 2007).

Often, deer-vehicle collisions in which a deer carcass was not recovered or little vehicle damage occurred go unreported. A Cornell University study estimates that the actual number of deer-vehicle collisions could be as high as six times the reported number (Decker et al. 1990). As Keith McCaffery (a retired deer biologist from Wisconsin) put it; "Seeing deer in the forest used to be a magical experience, now it's exciting only if they're coming through your windshield (Ness 2003).

1.4.3 Hazards at Airports

Airports provide ideal conditions for feeding and bedding sites for deer due to the large grassy areas adjacent to brushy, forested habitat used as noise barriers. Deer living within airport boundaries are usually protected from hunting and many other human disturbances.

Deer-aircraft strikes can result in loss of human life, injury to passengers or people on the ground, damage or malfunction of aircraft, aircraft navigational aids, or airport facilities. Mammals colliding with aircraft during the most vulnerable phases of flight, takeoff or landing, can cause the aircraft to crash or sustain physical damage (USDA 1998). Serious consequences are also possible if pilots loose control of the aircraft while attempting to avert a collision with deer. Mammals are characteristically unpredictable in their initial response to approaching aircraft. Deer may wander onto runway surfaces and be startled into the path of oncoming aircraft, and at night, they may freeze when caught in the beams of landing lights, resulting in a strike. The majority of deer strikes occur at night and in the fall during the mating season (Dolbeer et al. 1995).

From 1990-2003, the Federal Aviation Administration (FAA) received reports of 21 mammal strikes that resulted in 29 human injuries and 1 fatality. Deer were responsible for 7% of these mammal strikes that resulted in death or injury (FAA 2004). In Ohio, between 1990 and July 2007 there have been 77 reports of strikes involving aircraft and mammals (FAA National Wildlife Strike Database 2003, http://wildlife-mitigation.tc.faa.gov). Of these strikes, white-tailed deer strikes were the most costly to aircraft, resulting in over $1,432,000 worth of reported damage to aircraft. Damage costs can far exceed this as a strike in Alabama in 2001 resulted in the destruction of a Learjet 60 at a cost of $9.5 million (Cleary et al. 2002). The following are just a few examples of deer/aircraft strikes:

- On November 17, 1998, a private jet with 30 passengers was departing from Elko Nevada, when the bottom of the engine cowling struck a white-tailed deer, knocking off an antler. The entire antler was sucked into the engine forcing the plane to circle the airfield and land. The passengers were safely off-loaded, but the engine was destroyed. Damage was estimated at $300,000 (USDA 1998).

- On March 2, 1998, a Jetstream commuter in Johnstown, Maryland, collided with multiple white-tailed deer which caused the left main mount

to collapse and the aircraft to lose control and roll off the runway with ten passengers and crew on board. The incident required emergency procedures and demonstrated the seriousness of the deer-aircraft collision hazard to public safety (USDA 1998).

- On January 11, 1990, a Hawker Siddeley struck several deer during take off in Tennessee. One of the deer was completely ingested into the left engine. The impact tore the engine loose from the aircraft. The aircraft was replaced at a cost of 1.4 million dollars (Cleary et. al 2002).

- On January 2, 1992, a Piper 28 in Minnesota collided with a deer just prior to touchdown. The pilot added power and aborted the landing. Loss of engine power was experienced during the climb and the aircraft crashed into trees then the ground a ¼ mile south of the airport. The pilot was seriously injured and the aircraft was destroyed (Cleary et. al 2002).

- On December 6, 2000, an Embraer 120 in West Virginia collided with two deer just after landing. The tip of a propeller blade separated and punctured the fuselage, injuring a passenger, who later died (Cleary et. al 2002).

1.4.4 Damage to Landscaping and Natural Resources

Deer are considered a "keystone species," one that can have a profound impact on vegetation, altering species composition to the point that entire forests either fail to regenerate, or regenerate with tree species that are not beneficial for deer or other species of wildlife, or for lumber (Wallingford 2002). Deer browsing damages and destroys landscaping and ornamental trees, shrubs, and flowers. As rural areas are developed, deer habitat may actually be enhanced because fertilized lawns, gardens, and landscape plants serve as high quality sources of food (Swihart et al. 1995). Furthermore, deer are prolific and adaptable, characteristics that allow them to exploit and prosper in most suitable habitat near urban areas, including residential areas (Jones and Witham 1990). The succulent nature of many ornamental landscape plants, coupled with high nutrient contents from fertilizers, offers an attractive food source for deer. In addition to browsing pressure, male white-tailed deer damage ornamental trees and shrubs by antler rubbing which results in broken limbs and bark removal. While large trees may survive antler-rubbing damage, smaller saplings often die or become scarred to the point that they are not aesthetically acceptable for landscaping.

Deer overabundance can affect native vegetation and natural ecosystems. White-tailed deer selectively forage on vegetation (Strole and Anderson 1992), and thus can have substantial impacts on certain herbaceous and woody species and on overall plant community structure (Waller and Alverson 1997). These changes can lead to adverse impacts on other wildlife species, which depend on these plants for food and/or shelter. Numerous studies have shown that over browsing by deer can decrease tree reproduction, understory vegetation cover, plant density,

and plant diversity (Warren 1991). For example, in the Great Smokey Mountains National Park in Tennessee, an area heavily populated by deer had a reduction in the number of plant species, a loss of hardwood species and a predominance of conifer species compared to an ecologically similar control area with fewer deer (Bratton 1979).

The alteration and degradation of habitat from over-browsing by deer can have a detrimental effect on deer herd health and may displace other wildlife communities (e.g., neotropical migrant songbirds and small mammals) that depend upon the understory vegetative habitat destroyed by deer browsing (VDGIF 1999). Similarly, De Calesta (1997) reported that deer browsing affected vegetation that songbirds need for foraging surfaces, escape cover, and nesting. Species richness and abundance of intermediate canopy nesting songbirds was reduced in areas with higher deer densities (De Calesta 1997). Intermediate canopy-nesting birds declined 37% in abundance and 27% in species diversity at higher deer densities. Five species of birds were found to disappear at densities of 38.1 deer per square mile and another two disappeared at 63.7 deer per square mile. Casey and Hein (1983) found that 3 species of birds were lost in a research preserve stocked with high densities of ungulates and that the densities of several other species of birds were lower than in an adjacent area with lower deer density. Waller and Alverson (1997) hypothesize that by competing with squirrels and other fruit-eating animals for oak mast, deer may further affect many other species of animals and insects.

1.4.5 Managing Disease Risks to Humans, Livestock, and Wildlife

Wild and captive cervids carry a wide variety of diseases that can impact humans, pets, and livestock. Additionally, diseases that livestock may harbor can potentially have negative impacts on wildlife populations, including deer. WS involvement in the management of disease risks may include capturing wild deer and collecting samples for disease and parasites surveillance programs (may include lethal and nonlethal methods). WS may help landowners/managers reduce risk of contact and disease transmission between deer and wildlife and deer and people. Although incidence of a state wildlife agency using animal removal as a disease management technique is relatively rare, WS could, if requested by ODW, assist with deer removal for disease management. Below are some examples of some of the diseases that can affect deer, humans and/or livestock.

Lyme disease: Currently, the most common zoonosis involving deer is Lyme disease, caused by the spirochete *Borrelia burgdorferi* and vectored to humans by the deer tick (*Ixodes dammini* in the eastern U.S.) (Conover 1997). Initial symptoms of Lyme disease include a flu-like illness with headache, fever, muscle or joint pain, neck stiffness, swollen glands, jaw discomfort, and inflammation of the eye membranes (McLean 1994). If left untreated, heart, nervous system, and joint manifestations may develop (McLean 1994).

Research has shown a correlation between infected ticks, deer numbers, and Lyme disease cases (Deblinger et al. 1993, Magnarelli et al. 1984). Deer are an important reservoir for Lyme disease and are the primary host for the adult deer tick (Conover 1997). The Montgomery County Health Department (MCHD), Pennsylvania cites that Lyme disease incidence has also been linked to landscape features such as wooded, residential areas versus developed, urban areas (MCHD 2000). For the period of 2000-2006 there has been a yearly average of 59 cases of Lyme disease diagnosed in Ohio (range 43-82; Centers for Disease Control and Prevention (CDC) 2007).

Ehrlichiosis In 1986, another serious tick-borne zoonosis, human ehrlichiosis, was discovered in the United States (McQuiston et al. 1999). Two distinct forms of the illness may affect humans: human monocytic ehrlichiosis (HME) and human granulocytic ehrlichiosis (McQuiston et al. 1999, Lockhart et al. 1997). The bacterial agents that cause ehrlichiosis are transmitted to humans by infected ticks that acquire the agents from feeding on infected animal reservoirs (McQuiston et al. 1999). Ehrlichiosis in humans may result in fever, headache, myalgia, nausea, and occasionally death (McQuiston et al. 1999, Little et al. 1998). HME is the type of ehrlichiosis predominantly found in the southeastern, south-central, and mid-Atlantic U.S. White-tailed deer are major hosts for *Amblyomma americanum*, the tick that transmits HME, and deer have been identified as a reservoir for HME (Little et al. 1998, Lockhart et al. 1997). The first documented case of HME in humans in Ohio was in 2002. From 2002-2003 there have been 15 confirmed cases of HME (Ohio Department of Health (ODH), pers. comm.).

Bovine Tuberculosis: Tuberculosis (TB) is a contagious disease of both animals and humans and can be caused by three specific types of the Mycobacterium bacteria. Bovine TB, caused by *Mycobacterium bovis,* primarily affects cattle and other bovine-like animals (e.g., bison, deer, and goats) but can be transmitted to humans and other animals (Davidson and Nettles 1997). Pathogenesis of *M. bovis* infection in white-tailed deer begins with either inhalation or ingestion of infectious organisms. Transmission is aided by high deer density and prolonged contact, as occurs at supplemental feeding sites. Deer use of cattle feed (e.g. round bales) is likely a primary route of TB transmission between deer and cattle.

In 1917, the federal government established a bovine TB eradication program. Most states in the U.S. have been declared free of the disease (CDC 2005*b, c*). however, TB has been found in wild white-tailed deer and dairy herds in the Northern Lower Peninsula of Michigan and the state lost it's TB free status in 2000 (MDA 2004*a*). Loss of TB free status results in the imposition of quarantines and testing procedures which have serious economic impacts on the livestock industry in the affected area. In addition to white-tailed deer and cattle, studies in Michigan have identified TB antibodies in elk, coyotes, raccoons, black bears, bobcats, red foxes and Virginia opossums (MDA 2004*b*). The presence of TB in wildlife populations can complicate and delay efforts to eradicate TB in livestock (Davidson and Nettles 1997).

Humans most commonly become infected with this strain of TB through consumption of unpasteurized milk products from infected cows. For example, from 2001-2005, 35 *M. bovis* cases were identified in New York City. Preliminary investigations indicate that the cases were contracted from the consumption of unpasteurized milk products from Mexico (CDC 2005*b*). Human TB caused by *M. bovis* in the U.S. is rare because of milk pasteurization and culling of infected cattle herds. In 1917, the federal government established a bovine TB eradication program. In January 2005, the first-known case of transmission of TB from deer to humans was reported in Michigan. The hunter was infected when he cut his hand while gutting an infected deer. The hunter was treated with special antibiotics and was expected to make a full recovery.

Chronic Wasting Disease: Chronic wasting disease (CWD) is a neurological disease found only in cervids (members of the deer family) in North America. The disease belongs to a family of diseases known as transmissible spongiform encephalopathies. The disease attacks the brain of infected animals and produces small lesions that result in death.

CWD has not been found in Ohio. However, CWD has been identified in captive and/or wild cervids in several states and Canadian provinces. Efforts to detect CWD in Ohio deer began in 2002 and have continued through 2006. In cooperation with the Ohio Department of Agriculture (ODA) and ODW, WS has assisted with collection of CWD samples from hunter-harvested deer. In 2006, 8 WS employees assisted with the collection of CWD samples. All samples are tested by the Ohio Disease Diagnostic laboratory. Plans for CWD collection in 2007 are underway.

If WS selects and alternative that would allow for the use of lethal DDM techniques, WS would submit samples from a percentage of the deer killed for CWD testing. This testing could be expanded to testing for TB, FMD, and Epizootic Hemorrhagic Disease or other diseases.

Foot and Mouth Disease (FMD) is a severe, highly contagious vesicular viral disease of cloven-hoofed animals, including, but not limited to, cattle, swine, sheep, goats, and deer. The disease is rarely fatal in adult animals, although mortality in young animals may be high. FMD is endemic in Africa, Asia, South America, and parts of Europe but the United States has been free of FMD since 1929. Although it is often not fatal, FMD causes severe losses in the production of meat and milk and therefore has grave economic consequences. FMD does not infect humans or horses; however, both could potentially transmit the virus.

While FMD is primarily an economically devastating disease of livestock, experimental studies have clearly demonstrated that it also threatens wildlife. North American wildlife that are susceptible to FMD include white-tailed deer, other deer species, feral pigs, bison, moose, antelope, musk ox, caribou, sheep, and elk. Most free-living North American wildlife have had no previous virus

exposure, and there is little information available about their vulnerability (USGS NWHC 2001). In the even that FMD is diagnosed in Ohio the ODA and/or the ODW may request WS assistance in monitoring for and or managing the spread of the disease in wildlife.

1.4.6 Management of and Response to Disease in Captive Cervids

In the event that disease is found in captive cervids (e.g., CWD), the ODA and/or USDA, APHIS Veterinary Services may order the depopulation (killing) of the herd in order to prevent the spread of the disease to other captive cervids and/or the free-ranging deer population. ODA or VS may request assistance from WS in depopulating the herd. They may also request WS assistance in collecting samples from free ranging deer in the area surrounding the affected property in order to determine if the disease has already spread to the native white-tailed deer population.

1.5 Relationship of this EA to Other Environmental Documents

1.5.1 Wildlife Services Programmatic Environmental Impact Statement.

Wildlife Services conducted a NEPA process and developed a Final Environmental Impact Statement (FEIS) on the national APHIS/WS program (USDA 1997 Revised). The FEIS contains detailed discussions of potential environmental impacts from various WDM methods. Pertinent information from the FEIS has been incorporated by reference into this EA.

1.5.2 Environmental Assessment: Wildlife Damage Management at Airports in Ohio.

In January 2007, WS completed an EA evaluating the environmental impacts of alternatives for WS involvement in the management of wildlife hazards at airports, including hazards associated with deer at airports. Once completed, the analysis of DDM in this EA will supersede the analysis of deer hazards to aircraft in the Airport EA

1.5.3 Cuyahoga Valley National Park White-tailed Deer Management Plant and Environmental Impact Statement (EIS).

The Cuyahoga Valley National Park is developing a plan and associated EIS to manage white-tailed deer and deer damage to natural resources in the park. WS is a cooperating agency in the preparation of this analysis.

1.6 Decisions to be Made

Based on the scope of this EA, the decisions to be made are:

- Should WS implement an integrated DDM strategy, including technical assistance and direct control, to meet the need for DDM in Indiana?
- If not, should WS attempt to implement one of the alternatives to an integrated DDM strategy as described in the EA?
- Would the Preferred Alternative have significant impacts on the quality of the human environment requiring preparation of an EIS?

1.7 Scope of this Environmental Analysis

1.7.1 Actions Analyzed

This EA evaluates DDM by WS to protect human health and safety, property, natural resources and agricultural resources on private and/or public property whenever such management is requested from the WS program in Ohio. The actions proposed in this EA may be conducted on public and private lands.

1.7.2 American Indian Lands and Tribes

There are no federally recognized Native American Tribes or tribal lands in the state. If a Native American tribe is recognized in Ohio, WS would only work on tribal lands at the request of the tribe and only after an MOU or other appropriate agreement had been established between the tribe and WS. If WS enters into an agreement with a tribe for DDM, this EA would be reviewed and supplemented if appropriate to insure compliance with NEPA.

1.7.3 Period for which this EA is Valid

Unless it is determined that an EIS is needed, this EA will remain valid until WS determines that new needs for action or new alternatives having different environmental effects must be analyzed. At that time, this analysis and document will be reviewed and revised as necessary. This EA will be reviewed each year to ensure that it is complete and still accurately represents the scope and environmental impacts of WS state DDM activities.

1.7.4 Site Specificity

This EA analyzes the potential impacts of DDM and addresses activities on all private and public lands in Ohio under MOU, Cooperative Agreement, and in cooperation with the appropriate public land management agencies. It also

addresses the impacts of deer damage management on areas where additional agreements may be signed in the future. Because the Preferred Alternative is to reduce damage and because the program's goals and directives are to provide services when requested, within the constraints of available funding and workforce, it is conceivable that additional WDM efforts could occur. Thus, this EA anticipates this potential expansion and analyzes the impacts of such efforts as part of the program.

Planning for the management of deer damage must be viewed as being conceptually similar to federal or other agency actions whose missions are to stop or prevent adverse consequences from anticipated future events for which the actual sites and locations where they will occur are unknown but could be anywhere in a defined geographic area. Examples of such agencies and programs include fire and police departments, emergency clean-up organizations, insurance companies, etc. Although some of the sites where deer damage will occur can be predicted, all specific locations or times where such damage will occur in any given year cannot be predicted. This EA emphasizes major issues as they relate to specific areas whenever possible; however, many issues apply wherever deer damage and resulting management occurs, and are treated as such. The standard WS Decision Model (Slate et al. 1992) would be the site-specific procedure for individual actions conducted by WS in Ohio *(see* Description of Alternatives for a description of the Decision Model and its application).

The analyses in this EA are intended to apply to any action that may occur *in any locale* and at *any time* within Ohio. In this way, APHIS-WS believes it meets the intent of NEPA with regard to site-specific analysis and that this is the only practical way for WS to comply with NEPA and still be able to accomplish its mission.

1.7.5 Public Involvement/Notification

This supplement has been made available to the public for a comment period beginning on November 3, 2008 and ending on December 15, 2008. A notice of availability has been published in the Columbus Dispatch and has also been mailed directly to agencies, organizations, and individuals with probable interest in EA. A copy of the pre-decisional EA and a notice regarding the opportunity for public comment on the EA has also been made available at (http://www.aphis.usda.gov/ regulations/ws/ws_nepa_environmental_documents.shtml). Public notification procedures are in compliance with new WS NEPA implementation procedures published in the Federal Register March 21, 2007 (Vol. 72, No. 54: 13237-13238).

1.8 Authority and Compliance

1.8.1 Authority of Federal and State Agencies in White-tailed Deer Damage Management in Ohio

See Chapter 1 of USDA (1997 Revised) for additional discussion of federal laws pertaining to WS.

USDA, APHIS Wildlife Services Wildlife Services is the federal program authorized by law to help reduce damage caused by wildlife. The primary statutory authorities for the APHIS-WS program are the Act of March 2, 1931 (46 Stat. 1468; 7 U.S.C. 426-426b) as amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 U.S.C. 426c). The mission of the USDA/APHIS/WS program is to provide federal leadership in managing conflicts with wildlife. Wildlife Services' mission, developed through its strategic planning process (USDA 1989), is: 1) *"to provide leadership in wildlife damage management in the protection of America's agricultural, industrial and natural resources, and 2) to safeguard public health and safety."* Wildlife Services recognizes that wildlife is an important public resource greatly valued by the American people. By its very nature, however, wildlife is a highly dynamic and mobile resource that can cause damage to agriculture and property, pose risks to human health and safety, and affect industrial and natural resources. Wildlife Services conducts programs of research, technical assistance and applied management to resolve problems that occur when human activity and wildlife conflict.

Additionally, Memoranda of Understanding among WS and other governmental agencies also define WS responsibilities in WDM. For example, a Memorandum of Understanding between the Federal Aviation Administration (FAA) and WS recognizes WS role and expertise in providing wildlife hazard management assistance to the aviation community. It states, that the "FAA or the certificated airport may request technical and operational assistance from WS to reduce wildlife hazards."

Ohio Department of Natural Resources, Division of Wildlife (ODW) As authorized by Ohio Revised Code (ORC) 1531.04, "the ODW, at the direction of the chief of the division, shall do all of the following: (A) Plan, develop, and institute programs and policies based on the best available information, including biological information derived from professionally accepted practices in wildlife and fisheries management, with the approval of the director of natural resources; (B) Have and take the general care, protection, and supervision of the wildlife in the state parks known as Lake St. Marys, The Portage Lakes, Lake Loramie, Indian Lake, Buckeye Lake, Guilford Lake, such part of Pymatuning Reservoir as lies in this state, and all other state parks and lands owned by the state or in which it is interested or may acquire or become interested, except lands and lakes the care and supervision of which are vested in some other officer, body, board, association, or organization; (C) Enforce by proper legal action or proceeding the laws of the state and division rules for the protection, preservation, propagation,

and management of wild animals and sanctuaries and refuges for the propagation of those wild animals, and adopt and carry into effect such measures as it considers necessary in the performance of its duties" (ORC §1531.04).

Wildlife Services is in the process of updating the current MOU that defines USDA-APHIS-WS participation in a cooperative WDM program in Ohio. The MOU establishes a cooperative relationship between WS, ODA, ODH, ODNR, Ohio Department of Transportation, The Ohio state University Extension, and Ohio Agricultural Research and Development Center, for planning, coordinating and implementing WDM policies to prevent or minimize damage caused by wild animal species (including threatened and endangered species) to agriculture, horticulture, aquaculture, animal husbandry, forestry, wildlife, public health/safety, property, natural resources and to facilitate the exchange of information among the cooperating agencies.

Ohio Division of Wildlife wild animal permit No. 193 authorizes Ohio WS, on an annual basis to take, possess, and transport at any time and in any manner specimens of wild animals, subject to the following conditions and restrictions set forth by the chief of the ODW: (1) Permittee must collect non-endangered species as needed to fulfill requirements of USDA, (2) Permittee must consult with Crane Creek Research Station or the appropriate Wildlife District Office prior to moving any waterfowl, (3) All traps and devices must be tagged or marked identifying them as USDA property, (4) The use of chemical agents to control wild animals is prohibited without explicit permission from the Chief of the ODW, and (5) All nuisance wildlife species collected shall be immediately released at the site of capture or euthanized within 24 hours of collection. The permittee (WS) must also obtain all applicable Federal permits. State hunting and trapping regulations do not apply provided that the permittee is in full compliance with Federal laws, rules, and regulations.

Ohio Department of Agriculture

Ohio Department of Agriculture and its Division of Animal Industry is charged with protecting and promoting the health of Ohio's livestock and poultry industries. Responsibilities include livestock and poultry testing and inspection, licensing, controlling animal diseases in Ohio, and providing veterinary diagnostic laboratory services (http://www.ohioagriculture.gov/animal/). The ODA is also responsible for regulation of captive cervids.

United States Department of Interior (USDI), Fish and Wildlife Service (USFWS)

The primary responsibility of the USFWS is conserving fish, wildlife, plants and their habitats. While some of the USFWS's responsibilities are shared with other Federal, state, tribal, and local entities, the USFWS has special authorities in managing the National Wildlife Refuge System; conserving migratory birds, endangered species, certain marine mammals, and nationally significant fisheries; and enforcing Federal wildlife laws. Of particular importance to this EA is the USFWS' responsibility to implement and enforce the ESA of 1973, as amended.

1.8.2 Compliance with Federal Laws

Several federal laws authorize, regulate, or otherwise affect WS WDM. WS complies with these laws, and consults and cooperates with other agencies as appropriate.

National Environmental Policy Act All Federal actions are subject to NEPA (Public Law 91-190, 42 U.S.C. 4321 et seq.). NEPA sets forth the requirement that Federal actions with the potential to significantly affect the human environment be evaluated in terms of their impacts for the purpose of avoiding or, where possible, mitigating and minimizing adverse impacts. WS prepares analyses of the environmental effects of program activities to meet the requirements of this law.

Ordinarily, individual actions on the types of sites encompassed by this analysis may be categorically excluded under the APHIS Implementing Regulations for compliance with the National Environmental Policy Act (NEPA) (7 CFR 372.5(c)). APHIS Implementing Regulations also provide that all technical assistance furnished by WS is categorically excluded (7 CFR 372.5(c)) (60 Federal Register 6,000, 6,003 (1995)). However, WS has decided to prepare this EA to assist in planning DDM activities and to clearly communicate with the public the analysis of cumulative effects for a number of issues of concern in relation to alternative means of meeting needs for such management in the state, including the potential cumulative impacts on white-tailed deer and other wildlife species. This analysis covers current and future WS DDM actions by WS wherever they might be requested or needed within the state of Ohio.

Endangered Species Act It is federal policy, under the ESA, that all federal agencies shall seek to conserve Threatened and Endangered (T&E) species and shall utilize their authorities in furtherance of the purposes of the Act (Sec.2(c)). WS conducts Section 7 consultations with the USFWS to use the expertise of the USFWS to ensure that "*any action authorized, funded or carried out by such an agency . . . is not likely to jeopardize the continued existence of any endangered or threatened species . . . Each agency shall use the best scientific and commercial data available*" (Sec.7(a)(2)). Wildlife Services obtained a Biological Opinion from the USFWS (USDI 1992) describing potential effects of the national WS program on T&E species and prescribing reasonable and prudent measures for avoiding jeopardy (USDA 1997, Appendix F). Wildlife Services is in the process of initiating formal consultation at the programmatic level to reevaluate the 1992 B.O. WS also completed a separate informal review of the potential impacts of the actions proposed in this EA on federally-listed species (letter from M. Knapp, USFWS to A. Montoney, WS, January 18, 2008).

Federal Insecticide, Fungicide, and Rodenticide Act The federal Insecticide, Fungicide, and Rodenticide Act requires the registration, classification, and regulation of all pesticides used in the United States. The Environmental Protection Agency (EPA) is responsible for implementing and enforcing FIFRA.

All chemical methods used or recommended by the WS in Ohio, including deer repellents are regulated by the EPA and the ODA, and are used by WS in compliance with labeling procedures and requirements established by these agencies.

National Historic Preservation Act (NHPA) of 1966 as amended The NHPA of 1966, and its implementing regulations (36 CFR 800), requires federal agencies to: 1) determine whether activities they propose constitute "undertakings" that has the potential to cause effects on historic properties and, 2) if so, to evaluate the effects of such undertakings on such historic resources and consult with the Advisory Council on Historic Preservation (i.e. state Historic Preservation Office, Tribal Historic Preservation Officers), as appropriate. WS actions on tribal lands are only conducted at the tribe's request and under signed agreement; thus, the tribes have control over any potential conflict with cultural resources on tribal properties.

Each of the DDM methods described in this EA that might be used operationally by WS do not cause major ground disturbance, do not cause any physical destruction or damage to property, do not cause any alterations of property, wildlife habitat, or landscapes, and do not involve the sale, lease, or transfer of ownership of any property. In general, such methods also do not have the potential to introduce visual, atmospheric, or audible elements to areas in which they are used that could result in effects on the character or use of historic properties. Therefore, the methods that would be used by WS under the proposed action are not generally the types of activities that would have the potential to affect historic properties. If an individual activity with the potential to affect historic resources is planned under an alternative selected as a result of a decision on this EA, then site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary.

There is potential for audible effects on the use and enjoyment of a historic property when methods such as firearms or other noise-making methods are used at or in close proximity to such sites for purposes of hazing or removing animals. However, such methods would only be used at a historic site at the request of the owner or manager of the site to resolve a damage or nuisance problem, which means such use, would be to benefit the historic property. A built-in mitigating factor for this issue is that virtually all of the methods involved would only have temporary effects on the audible nature of a site and can be ended at any time to restore the audible qualities of such sites to their original condition with no further adverse effects. Site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary in those types of situations.

Environmental Justice and Executive Order 12898—"*Federal Actions to Address Environmental Justice in Minority Populations and Low Income Population"* Executive Order 12898, entitled, "Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations" promotes the fair treatment of people of all races, income levels and cultures with respect to the

development, implementation and enforcement of environmental laws, regulations and policies. Environmental justice is the pursuit of equal justice and protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status. It is a priority within APHIS and WS. Executive Order 12898 requires Federal agencies to make environmental justice part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of Federal programs, policies and activities on minorities and persons or populations of low income. APHIS implements Executive Order 12898 principally through its compliance with NEPA. All WS activities are evaluated for their impact on the human environment and compliance with Executive Order 12898. Wildlife Services personnel use only legal, effective, and environmentally safe WDM methods, tools, and approaches. It is not anticipated that the Preferred Alternative would result in any adverse or disproportionate environmental impacts to minorities and persons or populations of low income. Additionally, the donation of venison to charitable organizations would be a benefit to the economically disadvantaged, and to other persons in need.

Protection of Children from Environmental Health and Safety Risks (Executive Order 13045) Children may suffer disproportionately for many reasons from environmental health and safety risks, including the development of their physical and mental status. Because WS makes it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children, WS has considered the impacts that this proposal might have on children. The proposed white-tailed deer damage management program would occur by using only legally available and approved methods where it is highly unlikely that children would be adversely affected. For these reasons, WS concludes that it would not create an environmental health or safety risk to children from implementing this proposed action.

Fish and Wildlife Coordination Act (16 U.S.C. 661-667e) The Fish and Wildlife Coordination Act obligates all Federal agencies to consult with state resource agencies on actions related to wildlife conservation, including but not limited to actions "minimizing damages from overabundant species".

Coastal Zone Management Act of 1972, as amended (16 USC 1451-1464, Chapter 33; P.L. 92-583, October 27, 1972; 86 Stat. 1280). This law established a voluntary national program within the Department of Commerce to encourage coastal states to develop and implement coastal zone management plans. Funds were authorized for cost-sharing grants to states to develop their programs. Subsequent to Federal approval of their plans, grants would be awarded for implementation purposes. In order to be eligible for Federal approval, each state's plan was required to define boundaries of the coastal zone, to identify uses of the area to be regulated by the state, the mechanism (criteria, standards or regulations) for controlling such uses, and broad guidelines for priorities of uses within the coastal zone. In addition, this law established a system of criteria and standards for requiring that Federal actions be conducted in a manner consistent with the

federally approved plan. The standard for determining consistency varied depending on whether the Federal action involved a permit, license, financial assistance, or a federally authorized activity.

The lead and cooperating agencies have determined that the Preferred Alternative would be consistent with the state's Coastal Zone Management Program. The ODNR, Office of Coastal Management has concurred with this determination.

The Native American Graves and Repatriation Act of 1990 The Native American Graves Protection and Repatriation Act requires federal agencies to notify the Secretary of the Department that manages the federal lands upon the discovery of Native American cultural items on federal or tribal lands. Federal projects would discontinue work until a reasonable effort has been made to protect the items and the proper authority has been notified.

Federal Food, Drug, and Cosmetic Act (21 U.S.C. 360) This law places administration of pharmaceutical drugs, including those used in wildlife capture and handling, under the Food and Drug Administration.

Controlled Substances Act of 1970 (21 U.S.C. 821 et seq.) This law requires an individual or agency to have a special registration number from the federal Drug Enforcement Administration (DEA) to possess controlled substances, including those that are used in wildlife capture and handling.

Animal Medicinal Drug Use Clarification Act of 1994 (AMDUCA) The AMDUCA and its implementing regulations (21 CFR Part 530) establish several requirements for the use of animal drugs. Those requirements are: (1) a valid "veterinarian-client-patient" relationship, (2) well defined record keeping, (3) a withdrawal period for animals that have been administered drugs, and (4) identification of animals. A veterinarian, either on staff or on an advisory basis, would be involved in the oversight of the use of animal capture and handling drugs under the proposed action. Veterinary authorities in each state have the discretion under this law to establish withdrawal times (i.e., a period of time after a drug is administered that must lapse before an animal may be used for food) for specific drugs. Animals that might be consumed by a human within the withdrawal period must be identified; the Western Wildlife Health Committee of the Western Association of Fish and Wildlife Agencies has recommended that suitable identification markers include durable ear tags, neck collars, or other external markers that provide unique identification (WWHC undated). APHIS-WS establishes procedures in each state for administering drugs used in wildlife capture and handling that must be approved by state veterinary authorities in order to comply with this law.

CHAPTER 2: ISSUES AND AFFECTED ENVIRONMENT

2.1 Affected Environment

The area of the proposed action includes, but is not limited to, property on or adjacent to airports, recreational areas, parks, corporate complexes, subdivisions, businesses, industrial parks, schools, agricultural areas, and cemeteries. With the permission of the landowner/manager(s), the proposed action may be conducted on local, state or federal government property and private property.

2.1.1 Airports

Of all mammal species, deer are ranked as the most hazardous to aircraft, especially to smaller general aviation aircraft (Dolbeer et al. 2000), and they represent a serious threat to human health and safety. Airports are often secured areas with chain-link security fencing. Sometimes deer gain entrance into these airports where there is adequate cover and food, and they live there for all or part of the year. Because deer are ubiquitous throughout Ohio, it is possible for deer to be present at nearly any airport in the state.

2.1.2 Fenced Property

Private and government entities such as research facilities, corporate complexes and residential developments may have large controlled-access properties surrounded by fencing. These properties can be large enough to have a self-sustaining deer population within the boundaries of the fence. Public hunting is often not permitted at these locations for security and/or safety reasons which may lead to extremely high densities of deer at these sites. High densities of deer result in overuse of the vegetation and adverse impacts on the health of the herd. USDA WS may be called upon to reduce herd size at these sites.

2.1.3 Urban, Suburban and Rural Areas

Other areas were conflicts with deer occur include farms and rural areas where deer are causing damage to agriculture through feeding on crops and stored hay and antler rubbing. There are also risks of disease transmission between deer and livestock. Public and private properties in rural and urban/suburban areas may also be affected by deer damage to landscaping and native plant communities, and deer-vehicle collisions.

2.1.4 The “Environmental Status Quo” for Managing Damage and Conflicts Associated with State-managed or Unprotected Wildlife Species

As defined by NEPA implementing regulations, the "*human environment* shall be interpreted comprehensively to include the natural and physical environment *and*

the relationship of people with that environment." (40 CFR 1508.14). Therefore, when a federal action agency analyzes its potential impacts on the "human environment," it is reasonable for that agency to analyze the potential impacts of the federal action in context of the potential impacts that will occur in the absence of the federal action. This concept is especially applicable to situations involving damage associated with state-managed resident wildlife and unprotected wildlife species, because some level of WDM may occur even if the federal agency does not provide assistance.

Unprotected wildlife species (e.g., most non-native invasive species) are not protected under state or federal law. Most state-resident wildlife species are managed under state authority without any federal oversight or protection. When a non-federal entity takes a management action on a state-resident wildlife species or unprotected wildlife species, the action is not subject to the requirements of NEPA which only applies to federal decision-making. Under such circumstances, the environmental *baseline* or *status quo* is an environment that includes those species *as they are managed or impacted by non-federal entities in the absence of federal action*. In those situations in which a non-federal entity has decided that a management action will occur and the methods to be used with or without assistance from WS, WS's decision-making ability is restricted to one of two alternatives - either take the action using the specific methods as decided upon by the non-federal entity, or take no action at all at which point the non-federal entity will take the same action anyway. Under these circumstances, WS would have virtually no ability to affect the *environmental status quo* by selecting any possible alternative, even the alternative of no federal action by WS.

Therefore, based on the discussion above, it is clear that in those situations where a non-federal cooperator has obtained the appropriate ODW permit or authority, and has already made the decision to remove or otherwise manage white-tailed deer to stop damage with or without WS assistance, WS participation in carrying out the action will not affect the *environmental status quo*. In some situations, however, certain aspects of the human environment may actually benefit more from WS's involvement than from a decision not to assist. For example, if a cooperator believes WS has greater expertise to selectively remove a target species than a non-WS entity; WS management activities may have less of an impact on target and non-target species than if the non-federal entity conducted the action alone. Thus, in those situations, WS involvement may actually have a *beneficial* effect on the human environment when compared to the *environmental status quo* in the absence of such involvement.

2.2 Issues Analyzed in Detail

The following issues have been identified as areas of concern requiring consideration in this environmental assessment:

2.2.1 Effects on White-tailed Deer Populations

There are two general concerns regarding the impact of the alternatives on white-tailed deer populations. First, there is the concern that the alternative may result in the loss of local white-tailed deer populations or could have a cumulative adverse impact on the statewide white-tailed deer population. Second, in situations where the white-tailed deer population has reached high densities, there is concern that failure to reduce the population may result in increased risk of starvation and/or disease.

2.2.2 Effects on Plants and other Wildlife Species, including Threatened and Endangered Species

There are concerns among members of the public and wildlife professionals, including WS, that the proposed DDM methods may have unintended adverse impacts on nontarget species populations, particularly T&E species. To reduce the risks of adverse affects to nontarget species, WS would select damage management methods that are as target-selective as possible or apply such methods in ways to reduce the likelihood of negatively effecting nontarget species. Wildlife Services' standard operating procedures include measures intended to mitigate or reduce the effects on nontarget species populations (Section 3.6).

Special efforts are made to avoid jeopardizing state and federally-listed threatened and endangered species through biological evaluations of the potential effects of the proposed methods and the establishment of special restrictions or mitigation measures. Wildlife Services has consulted with the USFWS under Section 7 of the ESA concerning potential impacts of DDM control methods on T&E species (letter from M. Knapp, USFWS to A. Montoney, WS, January 18, 2008). Wildlife Services has also conducted a similar consultation with the ODW (letter from C. Caldwell, ODNR, to A. Montoney, WS, November 7, 2007.

As with impacts on deer populations, there are concerns that failure to adequately manage deer damage may lead to adverse impacts on the environment. Specifically, concerns that high densities of deer may have adverse impacts on native flora and fauna, and on the recovery of state and federally-listed species,

2.2.3 Effects on Human Health and Safety

A common concern is whether the Preferred Alternative or any of the alternatives pose an increased threat to human health and safety. In particular, there is concern that the methods of deer removal (e.g., sharpshooting) may be hazardous to people. Another concern is that high deer populations pose a threat to human health and safety through the potential for deer-vehicle collisions, deer-aircraft collisions, and the spread of disease.

Firearm use is a public concern because of fears relating to firearms misuse. To ensure safe and appropriate firearms use, WS employees who use firearms to conduct official duties are required to attend an approved firearms safety training program within 3 months of their appointment and a refresher course every 2

years thereafter (WS Directive 2.615). Wildlife Services employees, who use firearms as a condition of employment, are required to sign a form certifying that they meet the criteria as stated in the *Lautenberg Amendment* which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

2.2.4 Humaneness of methods to be used

The issue of humaneness, as it relates to the killing or capturing of wildlife is an important but complex concept. Humaneness appears to be a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. Pain and suffering as it relates to a review of WS damage management methods to capture animals, has both a professional and lay point of arbitration. Kellert and Berry (1980) in a survey of American attitudes toward animals related that 58% of their respondents, *" . . . care more about the suffering of individual animals . . . than they do about species population levels."* Schmidt (1989) indicated that vertebrate pest control for societal benefits could be compatible with animal welfare concerns, if *" . . . the reduction of pain, suffering, and unnecessary death is incorporated in the decision making process."*

Suffering has been described as a *" . . . highly unpleasant emotional response usually associated with pain and distress*." However, suffering *" . . . can occur without pain . . . ,"* and *" . . . pain can occur without suffering . . . "* (American Veterinary Medical Association (AVMA) 1986). Because suffering carries with it the implication of a time frame, a case could be made for *" . . . little or no suffering where death comes immediately . . . "* (California Department of Fish and Game 1991), such as the WS technique of shooting.

Defining pain as a component of humaneness may be a greater challenge than that of suffering. Pain obviously occurs in animals. Altered physiology and behavior can be indicators of pain, and things that causes pain in humans would *" . . . probably be causes for pain in other animals . . . "* (AVMA 1986). However, pain caused by a specific action or event probably varies between species and individuals from little or no pain to significant pain (CDFG 1991). Some WS damage management methods such as traps, may thus cause varying degrees of pain in different animal species for varying time frames. At what point pain diminishes or stops under these types of restraint has not been measured by the scientific community.

Wildlife managers and the public would both be better served to recognize the complexity of defining suffering, since *" . . . neither medical nor veterinary curricula explicitly address suffering or its relief"* (CDFG 1991). Research does suggest that with some methods, such as restraint in traps, changes in the blood chemistry of trapped animals indicate "*stress*" (USDA 1997: 3-81). However, such research has not yet progressed to the development of objective, quantitative measurements of pain or stress for use in evaluating humaneness.

The WDM decision-making process involves tradeoffs between the above aspects of pain and humaneness. An objective analysis of this issue must consider not only the welfare of wild animals but also the welfare of humans if damage management methods were not used. The challenge in coping with this issue is how to achieve the least amount of suffering with the constraints imposed by current technology and funding.

WS has improved the selectivity and humaneness of management devices through research and is striving to bring new findings and products into practical use. Until new findings and products are found practical, a certain amount of animal suffering could occur when some methods are used in those situations when non-lethal damage management methods are not practical or effective.

Ohio WS personnel are experienced and professional in their use of management methods so that they are as humane as possible under the constraints of current technology and funding. Standard Operating Procedures used to maximize humaneness are listed in Chapter 3 of this EA.

2.2.5 Effects on Aesthetic Values

Aesthetics is the philosophy dealing with the nature of beauty, or the appreciation of beauty. Therefore, aesthetics is truly subjective in nature, dependent on what an observer regards as beautiful. Wildlife generally is regarded as providing economic, recreational, and aesthetic benefits (Decker and Goff 1987), and the mere knowledge that wildlife exists is a positive benefit to many people. There is some concern that the alternatives could result in the loss of aesthetic benefits to the public, resource owners, or neighboring residents.

Social and economic benefits provided by wildlife include direct benefits related to consumptive and non-consumptive use (e.g., wildlife-related recreation, observation, harvest, sale), indirect benefits derived from vicarious wildlife related experiences (e.g., reading, television viewing), and the personal enjoyment of knowing wildlife exists and contributes to the stability of natural ecosystems (e.g., ecological, existence, bequest values; Bishop 1987, Decker and Goff 1987). Direct benefits are derived from a user's personal relationship to animals and may take the form of direct consumptive use (using up the animal or intending to) or non-consumptive use (viewing the animal in nature or in a zoo, photography) (Decker and Goff 1987). Indirect benefits or indirect exercised values arise without the user being in direct contact with the animal and come from experiences such as looking at photographs and films of wildlife, reading about wildlife, or benefiting from activities or contributions of animals such as their use in research (Decker and Goff 1987). Indirect benefits come in two forms: bequest and pure existence (Decker and Goff 1987). Bequest is providing for future generations and pure existence is merely knowledge that the animals exist (Decker and Goff 1987).

The human attraction to animals has been well documented throughout history and started when humans began domesticating animals. The American public is no exception and today a large percentage of households have pets. Some people may consider individual wild animals and birds as "pets" or exhibit affection toward these animals, especially people who enjoy coming in contact with wildlife.

The public reaction to WDM is variable and mixed because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the best ways to manage conflicts/problems between humans and wildlife. Ohio WS recognizes that all wildlife has aesthetic value and benefit. Wildlife Services would only conduct DDM at the request of the affected home/property owner or resource manager. If WS received requests from an individual or official for DDM, WS would address the issues/concerns and explain the reasons why the individual damage management actions would be necessary. Management actions would be carried out in a caring, humane, and professional manner.

2.2.6 Effects on Regulated White-tailed Deer Hunting

Some people may be concerned that deer removal activities conducted by WS would affect regulated deer hunting by reducing the number of deer that may be taken by hunters. Wildlife Services deer removal activities would primarily be conducted on populations and in areas where hunting access is restricted or has been ineffective. Lethal, management pressure applied to deer in these populations could serve to drive deer from these areas to places accessible to hunters.

2.3 Issues Not Considered in Detail with Rationale

2.3.1 Impact on Biodiversity

No Ohio WS DDM is, or will be, conducted to eradicate a native wildlife population. Wildlife Services operates according to international, federal, and state laws and regulations enacted to ensure species viability. In addition, any reduction of a local population or group is frequently temporary because immigration from adjacent areas and/or reproduction in the remaining replaces the animals removed. The impacts of the current WS program on biodiversity are minor and not significant nationwide, statewide, or region wide (USDA 1997). Wildlife Services operates on a small percentage of the land area of the state, and the maximum WS take of any wildlife species analyzed in this EA is a small percentage of the total population and is insignificant to the viability and health of the population.

2.3.2 Appropriateness of Preparing an EA (Instead of an EIS) For Such a Large Area

Some individuals might question whether preparing an EA for an area as large as the state of Ohio would meet the NEPA requirements for site specificity. If in fact a determination is made through this EA that the Preferred Alternative would have a significant environmental impact, then an EIS would be prepared. In terms of considering cumulative impacts, one EA analyzing impacts for the entire state may provide a better analysis than multiple EA's covering smaller zones. In addition, Ohio WS only conducts DDM in small areas of the state where damage is occurring or likely to occur.

CHAPTER 3: ALTERNATIVES

3.1 Introduction

This chapter consists of 6 parts: 1) an introduction, 2) a description of alternatives considered and analyzed in detail including Alternative 1 (the Preferred Alternative), 3) a description of IWDM, 4) DDM methods available for use or recommendation by WS in Ohio, 5) alternatives considered but not in detail, with rationale, and 6) standard operating procedures (SOPs) for DDM.

Alternatives were developed for consideration using the WS Decision Model (Slate et al. 1992), *"Methods of Control"* (USDA 1997, Appendix J), and the *"Risk Assessment of Wildlife Damage Control Methods Used by the USDA Animal Damage Control Program"* (USDA 1997, Appendix P).

The No Action alternative is a procedural NEPA requirement (40 CFR 1502), is a viable and reasonable alternative that could be selected, and serves as a baseline for comparison with the other alternatives. The No Action alternative, as defined here, is consistent with the Council on Environmental Quality's (CEQ's) definition (CEQ 1981). In this guidance, the No Action alternative for situations where there is an ongoing management program may be interpreted as "no change" from current management direction or level of management intensity.

The four alternatives analyzed in detail are:

- Alternative 1 – Integrated Deer Damage Management (Preferred Alternative)
- Alternative 2 – No Deer Damage Management by WS
- Alternative 3 – Technical Assistance
- Alternative 4 – Only non-lethal Deer Damage Management by WS

3.2 Alternatives Considered, Including the Preferred Alternative

Alternative 1: Integrated Deer Damage Management (Preferred Alternative)
Under this alternative, Wildlife Services, in consultation with the ODW, would implement an IWDM approach to alleviate white-tailed deer damage to agriculture, property, natural resources, and risks to human health and safety on all private and public lands of Ohio where a need exists, a request is received, and funding is available. The IWDM strategy would encompass the use of practical and effective nonlethal and lethal methods of preventing or reducing damage while minimizing harmful effects of damage management measures on humans, white-tailed deer, other species, and the environment. WS would provide site-specific technical assistance and operational damage management, including non-lethal and lethal management methods by applying the WS Decision Model (Slate et al. 1992). When appropriate, habitat modifications, harassment, repellants, legal hunting, and physical exclusion could be recommended and utilized to

reduce deer damage. In other situations, deer would be removed as humanely as possible by sharpshooting and live capture followed by euthanasia under permits issued by the ODW. In determining the damage management strategy, preference would be given to practical and effective non-lethal methods. However, non-lethal methods may not always be applied as a first response to each damage problem. The most appropriate response could often be a combination of non-lethal and lethal methods, or there could be instances where application of lethal methods alone would be the most appropriate strategy. All DDM would be consistent with other uses of the area and would comply with appropriate federal, state and local laws.

Alternative 2: No Deer Damage Management by WS
This alternative would eliminate WS involvement in all DDM activities. WS would not provide direct operational or technical assistance and all requesters for assistance with DDM would be referred to ODW, state and local extension agents, local animal control agencies, and/or private organizations. Individuals, organizations and agencies with deer damage problems would have to conduct their own DDM or contract for assistance from others.

Alternative 3: Technical Assistance
This alternative would only allow Ohio WS to provide technical assistance (advice) to individuals or agencies with deer damage. Individuals might choose to implement WS lethal and non-lethal recommendations on their own, implement methods not recommended by WS, use contractual services of private businesses, or take no action.

Alternative 4: Only Non-lethal Deer Damage Management by WS
This alternative would only allow WS to use and recommend non-lethal methods for DDM. Requests for information regarding lethal management approaches would be referred to the ODW, state and local extension agents, local animal control agencies, and/or private businesses or organizations. Persons incurring deer damage could still resort to lethal methods or other methods not recommended by WS, use contractual services of private businesses or take no action.

3.3 Deer Damage Management Strategies and Methodologies Available to WS

The strategies and methodologies described below include those that could be used or recommended under Alternatives 1, 3, and 4 described above. Alternative 2 would terminate both WS technical assistance and operational DDM. Appendix B contains a more thorough description of the methods that could be used or recommended by WS.

3.3.1 Integrated Wildlife Damage Management

The most effective approach to resolving wildlife damage is to integrate the use of several methods simultaneously or sequentially. The philosophy behind IWDM is to implement the best combination of effective management methods in a cost-

effective[2] manner while minimizing the potentially harmful effects on humans, target and non-target species, and the environment. Integrated Wildlife Damage Management may incorporate cultural practices (e.g., restructuring peak aircraft landing and takeoff times to avoid periods of high deer presence, Policies or regulations to prohibit wildlife feeding), habitat modification (i.e., exclusion), animal behavior modification (i.e., scaring), removal of individual offending animals, local population reduction, or any combination of these, depending on the circumstances of the specific damage problem.

3.3.2 Technical Assistance Recommendations

"Technical assistance" as used herein is information, demonstrations, and advice on available and appropriate WDM methods. Technical assistance is generally provided following an on-site visit or verbal consultation with the requester. Technical assistance includes demonstrations and advice on the proper use of management devices (pyrotechnics, exclusion devices, etc.), wildlife habits and biology, habitat management, exclusion, and animal behavior modification. In some cases, WS provides supplies or materials that are of limited availability for non-WS entities. Generally, several management strategies are described to the requester for short and long-term solutions to damage problems; these strategies are based on the level of risk, need, and the practicality of their application. Technical assistance may require substantial effort by WS personnel in the decision making process, but the actual work is the responsibility of the requester.

Under APHIS NEPA implementing regulations and specific guidance for the WS program, WS technical assistance is categorically excluded from the need to prepare an EA or EIS. However, it is discussed in this EA because it is an important component of the IWDM approach to resolving wildlife damage problems.

3.3.3 Direct Operational Damage Management Assistance

Direct Operational Damage Management is the implementation or supervision of damage management activities by WS personnel. Direct damage management assistance may be initiated when the problem cannot effectively be resolved through technical assistance alone, and when Agreements for Control or other comparable instruments provide for WS direct damage management. The initial investigation defines the nature, history, extent of the problem, species responsible for the damage, and methods that would be available to resolve the problem. Professional skills of WS personnel are often required to effectively resolve problems, if the problem is complex.

[2] The cost of management may sometimes be secondary because of overriding environmental, legal, human health and safety, animal welfare, or other concerns

3.3.4 Education

Education is an important element of WS's program activities because WDM is about finding "balance" or co-existence between the needs of people and needs of wildlife. This is extremely challenging as nature has no balance, but rather, is in continual flux. In addition to the routine dissemination of recommendations and information to individuals or organizations sustaining damage, lectures and demonstrations are provided to farmers, homeowners, and other interested groups. Wildlife Services frequently cooperates with other agencies in education and public information efforts. Additionally, technical papers are presented at professional meetings and conferences so that WS personnel, other wildlife professionals, and the public are updated on recent developments in damage management technology, laws and regulations, and agency policies.

3.3.5 WS Decision Making

The procedures used by WS personnel to determine management strategies or methods applied to specific damage problems can be found in USDA 1997, Appendix N.

Wildlife Services personnel use a thought process for evaluating and responding to damage complaints and requests for assistance that is depicted by the WS Decision Model described by Slate et al. (1992) (Figure 3-1). The Decision Model is not necessarily a written process, but a mental problem-solving process common to most, if not all professions. Wildlife Services personnel are frequently contacted after requesters have tried or considered non-lethal methods and found them to be impractical, too costly, or inadequate for reducing damage to an acceptable level. Wildlife Services personnel assess the problem and evaluate the appropriateness and availability (legal and administrative) of strategies and methods based on biological, economic and social considerations. Following this evaluation, the methods deemed to be practical for the situation are

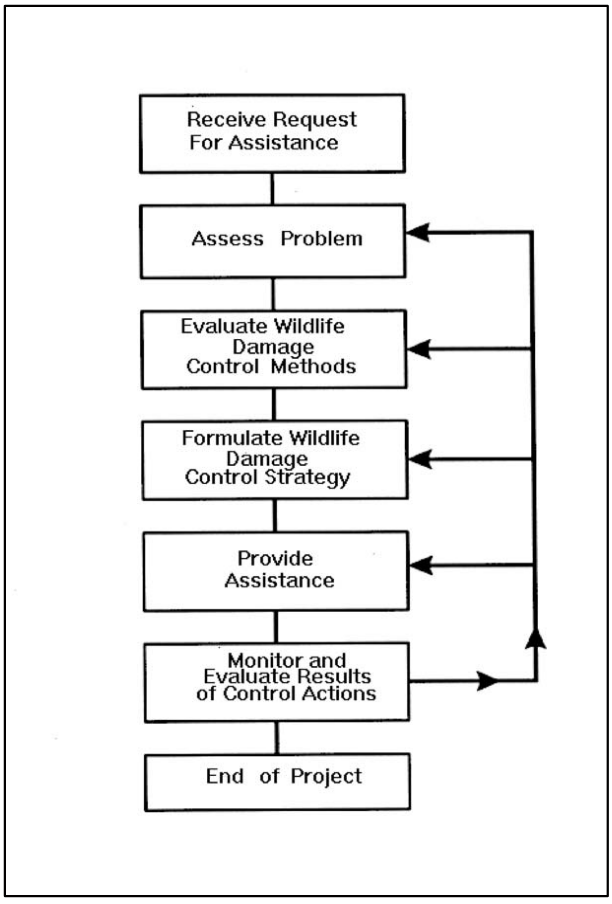

Figure 3-1. WS Decision Model

developed into a management strategy. After the management strategy has been implemented, monitoring is conducted and evaluation continues to assess the effectiveness of the strategy. If the strategy is effective, the need for further management may be ended. In some cases, continual conduct of effective WDM activities is necessary to relieve damage. In terms of the WS Decision Model (Slate et al. 1992), most damage management efforts consist of continuous feedback between receiving the request and monitoring the results of the ongoing damage management strategy.

3.3.6 Community-based Selection of a Deer Damage Management Program

The WS program in Ohio follows the "co-managerial approach" to solve wildlife damage or conflicts as described by Decker and Chase (1997). Within this management model, WS provides technical assistance regarding the biology and ecology of white-tailed deer and effective, practical, and reasonable methods available to reduce deer damage to local requesters. This includes non-lethal and lethal methods. Wildlife Services and other state and federal wildlife or WDM agencies may facilitate discussions at local community meetings when resources are available. Resource owners/managers and others directly affected by deer damage or conflicts in Ohio have direct input into the resolution of such problems. They may implement management recommendations provided by WS or others on their own, or may request management assistance from WS, other wildlife management agencies, local animal control agencies, or private businesses or organizations. Local authorities decide which methods should be used to solve a wildlife/human conflict. These decision makers include community leaders, private property owners/managers, and public property owners/managers. This process for involving local communities and local stakeholders in the decisions for DDM helps to insure that local concerns are considered before individual damage management actions are taken.

Community selection of a deer damage management program: The authority that selects damage management actions for the local community might be a mayor, city council, common council, park board, or for a homeowner or civic association would be the President or the President's or Board's appointee. These individuals are often elected residents of the local community who oversee the interests and business of the local community. These individuals would represent the local community's interest and make decisions for the local community or bring information back to a higher authority or the community for discussion and decision making. Decision making and involvement of the general public would be conducted in accordance with established procedures for the local community. WS would provide technical assistance to the local community or local business community authority(ies) and recommendations to reduce damage. Direct damage management would be provided by WS if requested by the local community authority, funding was provided, and the requested direct damage management was consistent with WS recommendations and federal and state laws.

Private property selection of a deer damage management program: When one person privately owns a parcel of property, the authority selecting the damage management plan would be the landowner/manager. These entities are not required to seek public involvement in their decision-making process. However, when developing a site-specific management plan, WS will make the landowner aware of sociological concerns regarding the various waterfowl damage management techniques. If multiple property owners are affected and no homeowner or civic association represents the affected resource owners in the local community, then WS would provide technical assistance to the self or locally appointed authority(ies). Direct damage management would be provided by WS if requested, funding was provided, and the requested direct damage management was consistent with WS recommendations, policy and federal and state laws. The affected resource owners would include those receiving damage and those whose property is adjacent to the areas where the deer primarily inhabit or damage resources. Affected resource owners who disagree with the direct damage management may request WS not conduct this action on their property and WS will honor this request; unless, as according to state law, the ODA or ODW has an animal health emergency and has requested WS involvement.

Public property selection of a deer damage management program: The authority selecting the damage management plan for local, state, or federal property would be the official responsible for or authorized to manage the public land to meet interests, goals and legal mandates for the property. Wildlife Services would provide technical assistance and recommendations to this person to reduce damage. Decision making and involvement of the general public would be conducted in accordance with the land management agency's established procedures. Wildlife Services would provide direct damage management if it was requested, funding was provided, and the requested direct damage management was consistent with WS recommendations, policy, and federal and state laws.

3.4 Wildlife Damage Management Methods Recommended or Authorized for Use

USDA (1997 Revised, Appendix J) describes methods currently used by the WS program. Several of these were considered in this assessment because of their potential use in reducing deer damage to agriculture, property, natural resources, and human health and safety. A listing and more detailed description of the methods used by Ohio WS for DDM is found in Appendix B of this EA.

3.4.1 Nonlethal Methods

Resource management: This method involves managing existing resources to discourage or eliminate the attractiveness of an area to deer or to minimize the likelihood that there will be conflict. Examples of this method include changes in human behavior (e.g., restructuring peak aircraft landing and takeoff times to

avoid periods of high deer presence), habitat modification, livestock management, and modifying crop cultural practices (e.g., reducing vegetative cover, forage crops, or using less palatable landscape plants).

Physical exclusion: Fencing, netting, or other barriers can limit deer access to a particular area. There are several types of fences that can inhibit deer access including: temporary electric, high tensile electric, woven wire, chain-link, and solid wall fencing Electrified mats and modified cattle guards have been used as barriers to deer movements through gates in fences. (http://www.aphis.usda.gov/ws/nwrc/is/Accomplishments_2005.pdf).

Behavior modification: The proper and integrated use of harassment techniques including auditory scaring techniques (pyrotechnics, propane exploders, electronic distress sounds, sirens, etc.) and visual scaring techniques (mylar ribbon, balloons, effigies, flashing lights, etc.) could help reduce deer activity at a site.

Repellents: Repellents fall under two categories, contact repellants and area repellants. Contact repellents (Deer Away® and Miller's Hot Sauce®) are those repellents that are applied to vegetation to discourage deer from browsing and, depending on the active ingredients and delivery system, are generally the most effective in reducing deer damage. Area repellents (Hinder® and Ro-pel®) are designed to repel deer by odor alone.

Live-capture/Trapping:
Live-capture methods for deer include: clover traps, box traps, drop nets, corral traps and rocket nets. These techniques may be used to live-capture deer for research projects, wildlife disease surveillance, and/or relocation.

Chemical Immobilization:
WS may use darts with immobilization drugs to live capture deer for research projects, wildlife disease surveillance, and/or relocation. Traces of drugs used for immobilization may remain in the animals system for days after the drug is administered. The drug withdrawal period is the term for the amount of time required for the drug to work its way out of the animals system and is stipulated on the label for the product. Immobilization drugs may not be used in free-ranging deer if hunting season starts before the end of the withdrawal period for the immobilizing drug unless the deer is moved to a holding facility for the duration of the withdrawal period. All use of immobilization drugs will be conducted in accordance with state and federal regulations.

Dogs:
Domestic dogs may be used in fenced enclosures to harass deer from agricultural crops (Vercauteren et al. 2005). Use of livestock protection dogs may also have potential to decrease deer intrusions into livestock pastures and livestock feeding areas, thereby decreasing the risk of disease transmission between deer and livestock. (http://www.aphis.usda.gov/ws/nwrc/is/Accomplishments_2005.pdf)

3.4.2 Lethal Methods

Sharpshooting: This method involves selectively shooting deer from tree stands, vehicles, or vantage points. When possible, deer killed by WS are donated for processing and distribution to charitable food organizations.

Live-capture and euthanasia: In some areas sharpshooting may be inappropriate due to safety concerns. Capture methods for deer include: darting with capture drugs, clover traps, box traps, drop nets, corral traps and rocket nets. Captured deer would be euthanized by methods recommended by the AVMA (Beaver et al. 2001) or per the recommendations of a veterinarian.

Hunting programs: Wildlife Services may recommend the use of state regulated firearm and archery deer hunting programs to reduce deer damage in a local area.

3.5 Alternatives Considered But Not Analyzed in Detail with Rationale

3.5.1 Live Trapping and Relocation

Under this alternative WS would capture deer using cage-type live traps, corral traps or capture drugs administrated by dart gun and then relocate the captured deer to another area. Numerous studies have shown that live-capture and relocation of deer is relatively expensive, time-consuming and inefficient (Ishmael and Rongstad 1984, O'Bryan and McCullough 1985, Diehl 1988, Jones and Witham 1990, Ishmael et al. 1995). Population reduction achieved through capture and relocation is labor intensive and would be costly ($273-$2,876/deer) (O'Bryan and McCullough 1985, Bryant and Ishmael 1991). Additionally, relocation frequently results in high mortality rates for deer (Cromwell et. al. 1999, O'Bryan and McCullough 1985, Jones and Witham 1990, Ishmael et. al. 1995). Deer frequently experience physiological trauma during capture and transportation, (capture myopathy) and deer mortality after relocation, from a wide range of causes within the first year, has ranged from 25-89% (Jones and Witham 1990, Mayer et al. 1993). O'Bryan and McCullough (1985) found that only 15% of radio-collared black-tailed deer that were live-captured and relocated from Angel Island, California, survived for one year after relocation. Although relocated deer usually do not return to their location of capture, some do settle in familiar suburban habitats and create nuisance problems for those communities (Bryant and Ishmael 1991). High mortality rates of relocated deer, combined with the manner in which many of these animals die, make it difficult to justify relocation as a humane alternative to lethal removal methods (Bryant and Ishmael 1991).

Chemical capture methods require specialized training and skill. A primary limitation of darting is that the range at which deer can be effectively hit, is limited, generally less than 40 yards. With modern scoped rifles, however, a skilled sharpshooter can hit the head or neck of a deer for a quick kill out to 200 yards and beyond (although a shot over 200 yards is not very likely). Thus, chemical capture is far less efficient, more labor intensive, and much more costly than lethal removal with rifles.

Translocation of wildlife is discouraged by WS policy (WS Directive 2.501) because of stress to the relocated animal, poor survival rates, potential for disease transfer and difficulties in adapting to new locations or habitats. Also many states no longer permit the interstate transfer of deer due to recent concerns of CWD outbreaks. If CWD is already present in Ohio relocating deer within the state could serve to spread the disease.

3.5.2 Population Stabilization/Reduction Through Birth Control

Reproductive control is often considered for use where wildlife populations are overabundant and where traditional hunting or lethal control programs are not publicly acceptable (Muller et. al. 1997). Use and effectiveness of reproductive control as a wildlife population management tool is limited by population dynamic characteristics (longevity, age at onset of reproduction, population size and biological/cultural carrying capacity, etc.), habitat and environmental factors (isolation of target population, cover types, and access to target individuals, etc.), sociological (ethical concerns), economics and other factors. Population modeling indicates that reproductive control is more efficient than lethal control only for some rodent and small bird species with high reproductive rates and low survival rates (Dolbeer 1998). Additionally, the need to treat a sufficiently large number of target animals, potential need for multiple treatments, and population dynamics of free-ranging populations place considerable logistic and economic constraints on the adoption of reproduction control technologies as a wildlife management tool for some species.

Reproductive control for wildlife could be accomplished either through sterilization (permanent) or contraception (reversible, initial treatment usually followed by a booster and annual follow-up treatments). Sterilization could be accomplished through: 1. Surgical sterilization (vasectomy, castration, and tubal ligation), 2. Chemosterilization, and 3. Gene therapy. Contraception could be accomplished through: 1. Hormone implantation (synthetic steroids such as progestins), 2. Immunocontraception (contraceptive vaccines), and 3. Oral contraception (progestin administered daily). Research into the use of these techniques would consist of laboratory/pen experimentation to determine and develop the sterilization or contraceptive material or procedure, field trials to develop the delivery system, and field experimentation to determine the effectiveness of the technique in achieving population reduction.

The use of hormones was investigated (Matschke 1976, 1977 a, b, c, and Roughton 1979), and eventually rejected as an effective and efficient reproductive control technique for deer. Additionally, concerns related to costs and logistics of widespread distribution of drugged baits, dosage control and ingestion of baits by children and nontarget animals make oral contraception (by steroids) largely impractical (Lowery et al. 1993). More recently, immunocontraception has been studied in various situations and locations, but its potential use appears limited due to considerable constraints regarding treatment and follow-up treatment of a sufficiently large number of target animals, varying immunogenecity of vaccines, genetic backgrounds of individual animals, age, nutritional status, stress and other factors (Becker et al. 1997, Becker et al. 1999). The use of porcine zona pellucida (PZP) as a contraceptive agent in wildlife management has been investigated (Kirkpatrick et al. 1990, Turner and Kirpatrick 1991, Turner et al. 1992, and Turner et al. 1996), but to date, there is no published documentation that immunocontraceptive vaccines have successfully reduced any free-ranging white-tailed deer herd or population.

USDA National Wildlife Research Center (NWRC) scientists have developed GonaCon™, a new single dose immunocontraceptive vaccine that shows great promise as a wildlife infertility agent. Recent studies have demonstrated the efficacy of this single-shot GnRH vaccine on California ground squirrels, Norway rats, feral cats and dogs, feral swine, wild horses and white-tailed deer. Infertility among treated female swine and white-tailed deer lasted up to 2 years without requiring a booster vaccination (Miller et al. 2000). This vaccine overcomes one of the major obstacles of previous two dose vaccines, the need to only capture animals once to vaccinate them. A single-injection vaccine is much more practical as a field delivery system for use on free-ranging animals. Ongoing studies initiated by NWRC in 2004, are examining the practicality of administering GnRH to free-ranging white-tailed deer as well as the efficacy, toxicity and safety of the vaccine. Although the GnRH immunocontraceptive appears promising, it has limitations. GnRH has been documented to have adverse impacts on antler growth in male deer (Miller and Killian 2001). If true, then it may be necessary to determine a way to only treat female deer or application may be limited to fenced-in sites where shifts in antler growth will not have as great an impact on the recreational and aesthetic value of the deer, or areas where cooperators have decided that the reduction in reproduction is worth the cost of altered antler growth in bucks (Miller et al. 2005).

Turner et al. (1993) noted that although contraception in white-tailed deer may be used to limit population growth, it will not reduce the number of deer in excess of the desired level in many circumstances. They further contend that initial population reductions by various other means may be necessary to achieve management goals, and that reproduction control would be one facet of an integrated program. In sum, although immunocontraceptive technology has been variously effective in laboratories, pens, and in island field applications, it has not been effective in reducing populations of free-ranging white-tailed deer.

The use of fertility control measures would be subject to approval by federal and state Agencies. No fertility control agents have been approved by FDA for non-investigational use on wildlife populations in the U.S., although several materials, including GnRH and PZP vaccines, have been classified as investigational drugs that may be used only in controlled research studies. National Wildlife Research Center studies that are underway at several locations are being conducted as pivotal studies that are required as part of FDAs approval process for a new animal drug.
Wildlife Services will continue to monitor the status of these immunocontraceptive technologies and revisit these techniques if they become available for use in Ohio.

In conclusion, this alternative was not considered in detail because:

- it would take a number of years of implementation before the deer population would decline and therefore, damage would continue at the present unacceptable levels for a number of years;

- surgical sterilization would have to be conducted by licensed veterinarians, and would therefore be extremely expensive;

- it is difficult, time-consuming, and expensive to effectively live trap, chemically capture, or remotely treat the number of deer necessary to effect an eventual decline in the population; and

- state and Federal regulatory authorities have approved no chemical or biological agent for use as a deer contraceptive.

3.6 Standard Operating Procedures

The current WS program, nationwide and in Ohio uses standard operating procedures to address issues and reduce risks associated with WDM activities (USDA 1997 Revised). Some key Standard Operating Procedures for DDM are listed in the following table.

Standard Operating Procedures	WS ALTERNATIVES			
	No Involve-ment	Tech. Asst.	Nonlethal	IWDM: No Action (Preferred)
Animal Welfare and Humaneness of Methods Used by WS				
Research on selectivity, effectiveness and humaneness of management practices would be monitored and adopted as appropriate.		X	X	X
The Decision Model (Slate et al. 1992) is used to identify effective biological and ecologically sound DDM strategies and their impacts.		X	X	X

As appropriate, euthanasia procedures approved by the AVMA that cause minimal pain are used for live animals.				X
The use of newly developed, proven nonlethal methods would be encouraged when appropriate.		X	X	X
Drugs are used according to the Drug Enforcement Agency, FDA, and WS program policies and directives and procedures are followed that minimizes pain.			X	X
Safety Concerns Regarding WS Damage Management Methods				
The Decision Model (Slate et al. 1992), designed to identify the most appropriate damage management strategies and their impacts, is used to determine DDM strategies.		X	X	X
All controlled substances are registered with DEA or FDA.			X	X
WS employees would follow approved procedures outlined in the WS Field Manual for the Operational Use of Immobilizing and Euthanizing Drugs (Johnson et al. 2001).			X	X
WS employees that use controlled substances are trained to use each material and are certified to use controlled substances under Agency certification program.			X	X
WS employees who use controlled substances participate in state approved continuing education to keep abreast of developments and maintain their certifications.			X	X
Controlled substance use, storage, and disposal conform to label instruction and other applicable laws and regulations, and Executive Order 12898.			X	X
Material Safety Data Sheets for controlled substances are provided to all WS personnel involved with specific WDM activities.			X	X
Concerns about Impacts of Damage Management on Target Species, T&E Species, Species of Special Concern, and Non-target Species				
WS consulted with the USFWS and the ODW regarding the proposed program and would continue to implement all applicable measures identified by the USFWS and the ODW to ensure protection of T&E species.			X	X
Management actions would be directed toward localized populations or groups and/or individual offending animals.		X	X	X
WS personnel are trained and experienced to select the most appropriate methods for taking targeted animals and excluding non-target species.			X	X
WS would initiate informal consultation with the USFWS following any incidental take of T&E species.			X	X
WS take is monitored by number of animals by species with overall populations or trends in population to assure the magnitude of take is maintained below the level that would cause significant adverse impacts to the viability of native species populations (See Chapter 4).				X
No deer repellents will be used or recommended in areas known to be used by Karner Blue Butterfly to avoid risks of adverse impacts on this species		X	X	X

CHAPTER 4: ENVIRONMENTAL IMPACTS OF DEER DAMAGE MANAGEMENT ALTERNATIVES

4.1 Introduction

Chapter 4 provides information needed for making informed decisions in selecting the appropriate alternative for meeting the purpose of the proposed action. This chapter analyzes the environmental consequences of each alternative in relation to each of the issues identified for detailed analysis in Chapter 2. The environmental consequences of each alternative are comparison with the no action alternative (Alternative 1) to determine if the real or potential effects would be greater, lesser, or the same.

The analysis for determining magnitude of impact generally follows the process described in Chapter 4 of USDA (1997 Revised). Magnitude is described in USDA (1997) as ". . . *a measure of the number of animals killed in relation to their abundance*." Magnitude may be determined either quantitatively or qualitatively. Quantitative determinations are based on population estimates, allowable harvest levels, and actual harvest data. Qualitative determinations are based on population trends and harvest data when available.

The following resource values within the State are not expected to be significantly impacted by any of the alternatives analyzed: soils, geology, minerals, water quality/quantity, flood plains, visual resources, air quality, prime and unique farmlands, timber, and range. These resources will not be analyzed further.

Cumulative Effects: Cumulative effects are discussed in relationship to each of the alternatives analyzed, with emphasis on potential cumulative effects from methods employed, and including summary analyses of potential cumulative impacts to target and non-target species, including T&E species.

Irreversible and Irretrievable Commitments of Resources: Other than minor uses of fuels for motor vehicles and other materials, there are no irreversible or irretrievable commitments of resources.

Effects on sites or resources protected under the National Historic Preservation Act: WS DDM actions are not undertakings that could adversely affect historic resources (See Section 1.8.2).

Social and Recreational Concerns
These concerns are discussed throughout the document as they relate to issues raised during public involvement, and they are discussed in USDA (1997 Revised).

4.2 Environmental Consequences for Issues Analyzed in Detail

Chapter 2 identified six issues of importance to the consideration of DDM in Ohio: effects on white-tailed deer populations; effects on plants and other nontarget wildlife species, including T&E species; effects on human health and safety; humaneness of methods to be used; effects on aesthetic values, and effects on regulated white-tailed deer hunting. This section contains a detailed analysis of each of these issues for all of the alternatives to be analyzed in detail.

4.2.1 Alternative 1: Integrated Deer Damage Management (Preferred Alternative)

Effects on white-tailed deer populations: Under this alternative, WS would be able to use nonlethal and lethal DDM methods. The ODW has authority for management white-tailed deer which are classified as protected big game. WS DDM activities would only be conducted after consultation with the ODW[3].

The ODW issues depredation permits to landowners to resolve damage problems. Over the period of 2001-2006, ODW issued an annual average of 1,619 deer damage control permits (range 1,091-2,149 permits/year) to landowner/managers to help address problems with damage to agriculture (ODW 2007). These permits resulted in the annual average take of 3,189 deer on in-[hunting]-season agricultural damage permits (range 1,572-4,365 deer per year) and 4,406 deer on out-of-season agricultural damage permits (range 2,278-6,039 deer per year). Maximum annual take under all damage management permits during this period was 10,404 deer in 2006. In 2007 the ODW discontinued the use of in-season permits and is placing greater emphasis on the use of hunting to resolve in-season damage problems. In 2007, ODW issued out-of-season agricultural permits allowing for the take of approximately 8,600. Data on actual take under these permits was not available at the time this report was prepared, but will be lower than the total number permitted. The ODW anticipates that future take under out-of-season agricultural damage permits is likely to remain stable or decrease (D. Risley, ODW, pers. comm.). In general, deer removal under agricultural permits is conducted/managed by the landowner. Instances where WS would be requested to provide assistance with deer removal to resolve agricultural damage (e.g., crop damage) would be rare. WS is more likely to become involved in deer removals to protect agricultural resources in situations where there is a risk of disease transmission between deer and livestock (e.g., TB). In these situations, WS could be requested to assist with capture and sampling of deer, or removal of deer from a select area where the disease has been detected (see below).

In addition to agricultural permits, the ODW issues permits to parks and urban/suburban areas to help resolve problems with natural resource and property damage and other problems associated with high local deer populations. These

[3] For purposes of this EA, consultation may include WS working under a ODW damage management permit that has been issued to a landowner/manager.

areas tend to be locations where use of hunting to reduce deer numbers has been ruled out because of factors such as community and/or landowner concerns regarding safety, conflicts with other site uses, or security requirements for the site. Data on the exact number of deer taken per year under these permits is not available, but is estimated to be approximately 5,000 deer per year. This is the types of damage management situation where WS would be most likely to receive a request for assistance with deer removal.

Based on the information above, the Ohio WS program expects that no more than 13,600 deer may be taken per year under deer depredation permits in the state (8,600 for agricultural damage, 5,000 for parks and urban/suburban areas). Up to 2,500 of these deer might be taken for landowners/managers by WS. Where appropriate, WS will donate deer killed during damage management projects for use in food assistance programs.

In addition to WS' intentional take of deer for DDM, WS also conducts some damage management activities which pose a risk of unintentional death of a deer, specifically projects to manage damage by coyotes, red fox, feral dogs, wolf-dog hybrids and exotic carnivores (USDA 2001). Unintentional deer take from other WS programs is not anticipated to result in the death of more than one or two individuals per year and will not raise WS cumulative deer take to over 2,500 deer per year. In the event of a disease outbreak (e.g., TB, CWD), the ODW might decide to remove deer for disease surveillance or to reduce the likelihood of disease transmission to livestock and the rest of the state deer herd. At the request of ODW, WS could assist with this effort which is not anticipated to result in WS taking more than 1,000 deer per year above the maximum of 2,500 discussed above.

Wildlife Services' assistance with removal of deer from captive cervid farms is not included in the deer population impact analysis because captive cervids do not contribute to and are not included in counts of the free-ranging deer population. Projects conducted to minimize disease in captive cervids are likely to have beneficial impacts because it minimizes the risk of disease transmission to the free-ranging deer population.

The ODW collects and compiles information on white-tailed damage complaints, take (licensed harvest and damage management permits) and population trends, and uses this information to manage deer populations and set deer harvest limits for the state deer management zones. The number of deer taken by licensed hunters has shown a generally increasing trend for the period of 2001-2006 (ODW 2007). Average annual take for 2003-2006 was 221,091 deer per year. Deer take by licensed hunters in 2006 was a record high of 237,316 deer.

The long-term trend for the Ohio deer population indicates an increase in deer numbers from 1998 until 2004 and then a decrease in the population until 2007 when there was a slight increase (http://www.dnr.state.oh.us/DesktopModules/Repository/MakeThumbnail.aspx?tabid=10580&id=118). The ODW estimates

that in 2007 there are about 675,000 deer in Ohio, slightly up from 2006 (ODW 2007). The decline in the state deer population since 2004 is in accordance with the management objectives of the ODW and does not indicate problems with the health or viability of the state deer population. Short-term local reductions in deer density may occur in areas were damage management activities are conducted, but, with the exception of projects to address deer hazards to aircraft at enclosed airports, would not result in elimination of deer from the treated area. The maximum predicted annual cumulative take for DDM by all sources of 13,600 deer per year (excludes deer removal in the instance of a disease outbreak) would be 5.9% of the sum of the 2004-2006 three-year annual average of 230,988 deer taken by all known causes (hunting licenses and damage management permits) and only 2.0% of the 2007 estimated deer population. WS' predicted annual maximum take of 2,500 deer would be 1.1% of the 2004-2006 three-year annual average of 230,988 deer taken by all a causes. In the event of a disease outbreak, the removal of up to 1,000 additional deer would increase deer take to 2.2% of the total population. Deer removals to address disease problems would only be conducted at the request of the ODW to protect the long-term health of the state deer population. Therefore, we conclude the proposed level of deer take by WS would not have a substantial impact on current deer population trends in the state and would not adversely impact the state deer population.

Effects on plants and other wildlife species, including T&E species: Direct impacts on non-target species occur if WS program personnel were to inadvertently kill, injure, or harass animals that are not target species. In general, these impacts result from the use of methods to capture or kill animals that are not completely selective for target species.

WS personnel are trained and experienced to select the most appropriate tools and methods for taking target animals and excluding non-targets. Shooting is virtually 100% selective for the target species; therefore no adverse impacts on nontarget species populations are anticipated from use of this method. WS personnel set live traps in locations that are conducive to capturing target animals while minimizing potential impacts to non-target species. Wildlife Services should be able to release any nontarget animal captured in a deer live trap on site. Therefore, WS take of non-target species is expected to be minimal or nonexistent. The only other potential averse impact on nontarget species would be the occasional scaring effect from the sound of gunshots and non-lethal harassment methods. In these cases, birds and other mammals may temporarily leave the immediate vicinity, but would most likely return after conclusion of the action.

Capture, sedating and euthanasia drugs would be used in accordance with applicable laws and regulations regulating their use. Adherence to these laws and regulations should avoid adverse effects on the environment. Based on a thorough Risk Assessment, APHIS concluded that, when WS program chemical methods are used in accordance with label directions, they are highly selective to

target individuals or populations, and such use has negligible effects on the environment (USDA 1997 Revised).

Deer overabundance can have a negative impact on native vegetation and natural ecosystems. White-tailed deer selectively forage on vegetation (Strole and Anderson 1992), and thus can have substantial impacts on certain herbaceous and woody species and on overall plant community structure (Waller and Alverson 1997). These changes can lead to adverse impacts on other wildlife species, which depend on these plants for food and/or shelter. Numerous studies have shown that over browsing by deer can decrease tree reproduction, understory vegetation cover, plant density, and plant diversity (Warren 1991). WS projects conducted to address problems with deer over browsing could potentially have beneficial impacts on nontarget species including threatened and endangered species.

WS has obtained the USFWS and ODW list of threatened and endangered species (Appendices C and D). After reviewing the state and federal list of threatened and endangered species, WS has determined that the proposed action will not adversely effect on threatened or endangered species in the state. However, as noted above, the proposed action may have beneficial impacts on species that are adversely impacted by excessive browsing by high densities of deer. The ODNR has concurred with WS' determination that the proposed action will not adversely affect state-listed species and has the potential for beneficial impacts on some state-listed species in areas where there is substantial deer browsing on herbaceous and woody vegetation (letter from C. Caldwell, ODNR, letter to A. Montoney, WS, November 7, 2007). The USFWS has concurred that the proposed action may affect but is unlikely to adversely affect the American burying beetle, Mitchell's satyr butterfly, running buffalo clover, lakeside daisy, Northern Monkshood, Eastern prairie fringed orchid, Virginia spirea, and small whorled pagonia (letter from M. Knapp, USFWS, to A. Montoney, WS, January 18, 2008).

Effects on human health and safety: This alternative would have the greatest potential to reduce threats to public health and safety from a site by alleviating potential threats of transmitting diseases, and potential deer/aircraft and deer/vehicle collisions since all available lethal and nonlethal methods could be considered for use or recommended.

Shooting with shotguns or rifles and the use of controlled substances (immobilization and euthanasia drugs) could be used to reduce deer damage under this alternative. WS follows established safety precautions when conducting damage management activities and complies with all applicable laws and regulations governing the lawful use of management methods. WS' traps are strategically placed to minimize exposure to the public. Appropriate signs are posted on all properties where traps are set to alert the public of their presence.

The use of firearms can be a concern to the public because of the carelessness and misuse of firearms by some individuals. To ensure safe use and awareness, WS employees who use firearms to conduct official duties are required to attend an approved firearms safety-and-use training program within three months of their appointment and a refresher course every two years afterwards (WS Directive 2.615). WS employees, who use firearms as a condition of employment, are required to certify that they meet the criteria as stated in the *Lautenberg Amendment* which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

WS's DDM methods poses minimal or no threat to human health and safety. A formal risk assessment of WS' operational management methods found that risks to human safety were low (USDA 1997 Revised, Appendix P). Therefore, no adverse affects on human safety from WS' use of DDM methods is expected.

Humaneness of methods to be used: WS personnel are experienced and professional in their use of management methods, and methods are applied as humanely as possible. Under this alternative, deer would be shot or captured as humanely as possible by experienced WS personnel using the best method available. However, use of lethal DDM method will be perceived as inhumane by some individuals opposed to the used of any lethal damage management techniques.

Researchers at the University of Minnesota conducted a 2001 study for Cuyahoga Valley National Park to aid in the preparation of their EIS on deer management at the park (http://www2.nature.nps.gov/YearInReview/yir2001/02_management/02_5_skerl.html). Most respondents indicated that the deer management issue is important to them personally and is related to their personal values. Survey results revealed that approximately two-thirds of respondents found lethal control acceptable, while only one in six felt that taking no action was acceptable. Additionally, the majority of respondents indicated that they would experience no negative emotional effects from lethal control.

Respondents showed high general confidence in the Park Service, and 80% indicated that they would not change their use of the park or the opinion of park staff should lethal control be implemented. However, 20% of respondents found lethal control unacceptable and would be very upset by such actions. A similar number indicated that such a program would keep them from visiting the park or participating in park activities.

Effects on sociological issues including aesthetic value: Public perceptions of the impact of this alternative on aesthetic values would be variable and mixed because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the best ways to reduce conflicts/problems between humans and wildlife. The impacts of this alternative to stakeholders would also be variable depending on the relationship of the individual to the damage problem.

Most resource owners who are incurring damage would likely favor this alternative as it allows WS to provide advice and assistance using the full range of legally-available DDM methods. An IWDM approach, which includes non-lethal and lethal methods, provides relief from damage or threats to human health or safety to those people who would have no relief from such damage or threats if non-lethal methods were ineffective or impractical. An effective DDM program could provide aesthetic benefits to individuals who feel that their enjoyment of a site has been adversely impacts by deer damage to vegetation. Some people would strongly oppose removal of the deer regardless of the amount of damage they incur, because they feel it is morally wrong to kill animals to resolve a damage problem or that lethal methods are disproportionate to the nature of the problem.

Individuals not directly affected by the threats or damage may be supportive, neutral, or totally opposed to any removal of deer from specific locations or sites. Individuals who favor the aesthetic value of deer over potential consequences to vegetation may be opposed to deer removal to reduce damage problems. Some people that totally oppose lethal damage management want WS to teach tolerance for deer damage and threats to public health or safety, and that deer should never be killed.

The ability to view and aesthetically enjoy deer at a particular site could decrease if the density of deer at the site is reduced to minimize damage problems. However, in most instances, there would still be deer available at the site for individuals to enjoy. Reproduction by deer remaining at the site and immigration of new individuals will likely return the site to pre-control densities unless there are ongoing efforts to maintain reduced deer density. The opportunity to view deer is available if a person makes the effort to visit sites with adequate habitat outside of the damage management area. Only in limited situations involving high-security fenced enclosures (e.g., airports), would WS attempt to remove all deer. These enclosed sites are unlikely to be open to public access and wildlife observation and deer removal at these locations is unlikely to adversely impact deer viewing opportunities.

Effects on regulated white-tailed deer hunting: The ODW favors the use of hunting to address problems associated with deer overabundance. Lethal removal of deer by WS personnel would only occur after consultation with the ODW. As noted in Chapter 3, where appropriate, WS will recommend landowners/mangers use recreational hunting to address their damage problems. However, in most situations where WS would be involved in lethal DDM, local regulations, agency land use restrictions, or safety/security concerns at the site (e.g., airport security) prohibit the use of hunting. and/or because there is strong landowner and/or local community opposition to the use of hunting as a damage management technique. In these instances, if WS were not to provide assistance with lethal deer removal, the landowner/manger would either conduct the deer removal on their own or seek assistance from private contractor. It is highly unlikely that the

landowner/manager would resort to the use of licensed hunting. Consequently, WS involvement in these situations is unlikely to have substantial impact on opportunities for deer hunting.

In the few instances where WS conducts lethal DDM activities at a site where deer hunting would be permitted (usually instances of off-season damage problems), WS activities may reduce deer densities in the local project area, hence slightly reducing the number of deer that may otherwise be available to hunters during hunting seasons. The impact of this activity, however, is expected to be minimal because:

A. the maximum number of deer expected to be killed by WS is minimal when compared to the number taken by hunters (1.10 % of the average 2004-2006 annual hunter harvest of deer);
B. Most sites where WS would conduct DDM are not likely to be open to hunters so the majority of WS impact would not be in hunted areas; and
C. WS involvement in DDM is not anticipated to have an adverse impact on the state deer population.

4.2.2 Alternative 2: No Deer Damage Management by WS

This alternative would eliminate WS involvement in all DDM activities. WS would not provide direct operational or technical assistance and all requests for assistance with DDM would be referred to ODW, state and local extension agents, local animal control agencies, and/or private organizations. Individuals, organizations and agencies with deer damage problems would have to conduct their own DDM or contract for assistance from others. Environmental impacts of this alternative are the environmental status quo discussed in Section 2.1.4.

Effects on white-tailed deer populations: Because it is possible for non-WS entities to obtain permits for DDM from ODW, and obtain access to all DDM methods proposed in this EA, total take of deer and impacts on the statewide deer population are likely to be similar to Alternative 1, the proposed action/no action alternative. In the absence of readily available assistance from WS, it's possible some resource/property owners may take illegal, unsafe, or environmentally harmful action against local populations of deer out of frustration or ignorance (USDA 1997, White et al. 1989, USFWS 2001, USFDA 2003). Consequently, total impact on the deer population is likely to be similar to or slightly higher than the proposed action.

Effects on plants and other wildlife species, including T&E species:
WS would not be involved in DDM, and therefore, would have no direct impacts on plants and nontarget wildlife species. In the absence of a WS DDM program, impacts of non-WS actions will depend on the training, experience and resources available to the individuals conducting the DDM program. If the individuals conducting the program have training and resources similar to WS, impacts will be similar to Alternative 1. However, individuals with little or no shooting

experience may attempt to remove deer. These inexperienced individuals may be more likely than WS personnel to take a non-target species.

Damage caused by deer to wildlife species, including T&E species, may continue or increase in those situations where the resource/property owner does not implement their own DDM program and in those situations where a resource/property owner does not have the resources or abilities to implement as effective a DDM program as WS. It may also take less experienced individuals longer to resolve a damage problem

Effects on human health and safety: WS would not conduct DDM and would have no direct impact on this issue. Potential threats to human health and safety caused by deer may continue or increase in those situations where the resource owner/manager does not implement their own DDM program; or in those situations where a resource owner/manager does not have the resources or experience to implement an effective DDM program. In the absence of a WS DDM program, individuals with little or no shooting experience may attempt to remove deer. There could be increased risks to human health and safety from improper or inexperienced use of damage management methods.

Humaneness of methods to be used: Some people might consider this alternative humane because WS would not be involved in DDM. However, resource owners/managers could still use lethal and non-lethal methods to reduce deer damage so elimination of WS involvement will not eliminate the use of lethal techniques. There may be a higher risk of nonlethal wounding of animals and potential for increased pain if shooting is conducted by less experienced individuals. Some resource/property owners may take illegal action against localized populations of deer out of ignorance or frustration with continued damage. These illegal actions may be less humane than methods used by experienced WS personnel.

Effects on sociological issues including aesthetic values: The impacts of this alternative on stakeholders would be variable depending on their values towards wildlife and their relationship to the damage problem. Resource owners/ managers experiencing deer damage may oppose this alternative because they perceive it an inappropriate denial of assistance with problems caused by a public resource (deer). In situations where the non-WS DDM program is less effective than a WS program, there may be more damage to vegetation including landscaping which some individuals will perceive as an adverse impact on the aesthetic value of the site.

Some individuals would prefer this alternative because they believe it is morally wrong to kill or use animals for any reason and that the government should not be involved in killing deer. Some people would support this alternative because they enjoy seeing deer, or having deer nearby and mistakenly assume that the absence of a WS program would mean the absence of lethal DDM. However, while WS would take no action under this alternative, other individuals or entities could, and

likely would, conduct DDM activities resulting in impacts similar to the Preferred Alternative.

Effects on regulated white-tailed deer hunting: Under this alternative, resource owners/managers would still be able to obtain permits from the ODW to remove deer. Overall impacts on deer hunting opportunities would be similar to Alternative 1 and would not be of sufficient magnitude to adversely impact hunting opportunities.

4.2.3 Alternative 3: Technical Assistance

Effects on white-tailed deer populations: No direct DDM activities would be conducted by WS under this alternative. It would still possible for non-WS entities to obtain permits for DDM from ODW, and obtain access to all DDM methods proposed in this EA, total take of deer and impacts on the statewide deer population are likely to be similar to the preferred alternative. Local deer populations could decline, stay the same, or increase depending on actions taken by others. Some resource/property owners may kill deer, or allow other hunters access to hunt deer, during the hunting season. Deer populations could continue to increase where hunting pressure was low or when an insufficient number of deer are removed under special permits issued by the ODW. Some local populations of deer would temporarily decline or stabilize where hunting pressure and permitted removal activities were adequate. Some resource/property owners may take illegal, unsafe, or environmentally harmful action against local populations of deer out of frustration or ignorance (USDA 1997, White et al. 1989, USFWS 2001, USFDA 2003), but the availability of technical assistance from WS may reduce this type of problem from the level that could occur under Alternative 2. Overall risks from inexperienced/inappropriate DDM activities would likely be slightly higher than with Alt. 1.

Effects on plants and other wildlife species, including T&E species: In the absence of an integrated DDM program some resource/property owners with little or no shooting experience may attempt to remove deer. These inexperienced individuals may be more likely than WS personnel to take a non-target species and not report non-target take. The availability of technical assistance from WS may reduce this type of problem from the level that could occur under Alternative 2.

Damage caused by deer to wildlife species, including T&E species, may continue or increase in those situations where the resource/property owner does not implement their own DDM program and in those situations where a resource/property owner does not have the resources or abilities to implement as effective a DDM program as WS. It may also take less experienced individuals longer to resolve a damage problem. However, WS will be able to provide advice on DDM, so risks of these types of adverse impacts are likely lower than with Alternative 2.

Effects on human health and safety: WS would not conduct DDM and would have no direct impact on this issue. Potential threats to human health and safety caused by deer may continue or increase in those situations where the resource owner/manager does not implement their own DDM program; or in those situations where a resource owner/manager does not have the resources or experience to implement an effective DDM program. In the absence of a WS DDM program, individuals with little or no shooting experience may attempt to remove deer. There could be increased risks to human health and safety from improper or inexperienced use of damage management methods. However, WS will be able to provide advice on DDM, so risks of these types of threats are likely lower than with Alternative 2.

Humaneness of methods to be used: Some people might consider this alternative humane because WS would not be involved in DDM. However, resource owners/managers could still use lethal and non-lethal methods to reduce deer damage so elimination of WS involvement will not eliminate the use of lethal techniques. There may be a higher risk of nonlethal wounding of animals and potential for increased pain if shooting is conducted by less experienced individuals. Some resource/property owners may take illegal action against localized populations of deer out of ignorance or frustration with continued damage. These illegal actions may be less humane than methods used by experienced WS personnel. The availability of assistance from WS may reduce the risk of illegal action from that which might occur under Alternative 2.

Effects on sociological issues including aesthetic values: The impacts of this alternative on stakeholders would be variable depending on their values towards wildlife and their relationship to the damage problem. Resource owners/managers experiencing deer damage may oppose this alternative because they perceive it an inappropriate denial of assistance with problems caused by a public resource (deer). In situations where the non-WS DDM program is less effective than a WS program, there may be more damage to vegetation including landscaping which some individuals will perceive as an adverse impact on the aesthetic value of the site.

Some individuals would prefer this alternative because they believe it is morally wrong to kill or use animals for any reason. Some people would support this alternative because they enjoy seeing deer, or having deer nearby. However, while WS would take no action under this alternative, other individuals or entities could, and likely would, conduct DDM activities resulting in impacts similar to the preferred alternative.

Effects on regulated white-tailed deer hunting: Under this alternative, resource owners/managers would still be able to obtain permits from the ODW to remove deer. Overall impacts on deer hunting opportunities would be similar to Alternative 1 and would not be of sufficient magnitude to adversely impact hunting opportunities.

4.2.4 Alternative 4: Only Non-lethal Deer Damage Management by WS

Effects on white-tailed deer populations: Because it is possible for non-WS entities to obtain permits for DDM from ODW, and obtain access to all DDM methods proposed in this EA, total take of deer and impacts on the statewide deer population are likely to be similar to Alternative 1, the proposed action/preferred alternative. In the absence of readily available assistance from WS, its possible some resource/property owners may take illegal, unsafe, or environmentally harmful action against local populations of deer out of frustration or ignorance (USDA 1997, White et al. 1989, USFWS 2001, USFDA 2003). Consequently, total impact on the deer population is likely to be similar to or slightly higher than the proposed action.

Effects on plants and other wildlife species, including T&E species: In the absence of an integrated DDM program some resource/property owners with little or no shooting experience may attempt to remove deer. These inexperienced individuals may be more likely than WS personnel to take a non-target species and not report non-target take.

Damage caused by deer to wildlife species, including T&E species, may continue or increase in those situations where the resource/property owner does not implement their own DDM program and in those situations where a resource/property owner does not have the resources or abilities to implement as effective a DDM program as WS. It may also take less experienced individuals longer to resolve a damage problem

Effects on human health and safety: Concerns regarding WS use of lethal methods would be alleviated under this alternative. WS would not conduct DDM and would have no direct impact on this issue. Potential threats to human health and safety caused by deer may continue or increase in those situations where the resource owner/manager does not implement their own DDM program; or in those situations where a resource owner/manager does not have the resources or experience to implement an effective DDM program. In the absence of a WS DDM program, individuals with little or no shooting experience may attempt to remove deer. There could be increased risks to human health and safety from improper or inexperienced use of damage management methods.

Non-lethal methods would not be efficient or successful in resolving many deer damage situations. There are potential for increased threats to human health and safety when non-lethal methods are ineffective and non-WS personnel do not effectively reduce local deer herds. The reduction of deer induced human health and safety threats would be similar to those described under the Preferred Alternative in those situations where non-lethal methods are effective at reducing damage to acceptable levels. In those situations where non-lethal methods are ineffective impacts would be similar to Alternative 2.

Humaneness of methods to be used: : Some people might consider this alternative humane because WS would not be involved in any lethal DDM. However, resource owners/managers could still use lethal and non-lethal methods to reduce deer damage so elimination of WS involvement with lethal management will not eliminate the use of lethal techniques. There may be a higher risk of nonlethal wounding of animals and potential for increased pain if shooting is conducted by less experienced individuals. Some resource/property owners may take illegal action against localized populations of deer out of ignorance or frustration with continued damage. These illegal actions may be less humane than methods used by experienced WS personnel.

Effects on sociological issues including aesthetic values: The impacts of this alternative on stakeholders would be variable depending on their values towards wildlife and their relationship to the damage problem. Resource owners/managers experiencing deer damage may oppose this alternative because they perceive it an inappropriate denial of lethal assistance with problems caused by a public resource (deer). In situations where non-lethal programs are less effective than lethal programs, there may be more damage to vegetation including landscaping which some individuals will perceive as an adverse impact on the aesthetic value of the site.

Some individuals would prefer this alternative because they believe it is morally wrong to kill or use animals for any reason. Some people would support this alternative because they enjoy seeing deer, or having deer nearby. However, while WS would only utilize nonlethal techniques under this alternative, other individuals or entities could, and likely would, conduct lethal DDM activities resulting in impacts similar to the preferred alternative.

Effects on regulated white-tailed deer hunting: WS would have no impact on regulated deer hunting since WS would not lethally remove deer under this alternative. However, under this alternative, resource owners/managers would still be able to obtain permits from the ODW to remove deer. Overall impacts on deer hunting opportunities would be similar to Alternative 1 and would not be of sufficient magnitude to adversely impact hunting opportunities.

4.3 Cumulative Impacts

Cumulative impacts, as defined by CEQ (40 CFR 1508.7), are impacts to the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts may result from individually minor, but collectively significant, actions taking place over time.

Cumulative Impacts on Wildlife Populations
Deer damage management methods used or recommended by the WS program will likely have no cumulative adverse effects on target and non-target wildlife populations. WS limited lethal take of white-tailed deer is anticipated to have minimal impacts on overall deer populations in Ohio. When control actions are implemented by WS the potential lethal take of non-target wildlife species is expected to be minimal to non-existent.

Cumulative Impact Potential from Chemical Components
Repellants and immobilization/euthanasia drugs may be used or recommended by WS. Characteristics and use patterns of these methods indicate that no significant cumulative impacts are expected from their use in WS DDM programs.

Cumulative Impact Potential from Non-chemical Components
Non-chemical methods used or recommended by WS may include exclusion, habitat modification, trapping, harassment methods and shooting. No cumulative impacts from WS use of these methods are expected.

SUMMARY
No substantial adverse cumulative environmental impacts are expected from any of the 4 alternatives. Under the Preferred Alternative, the lethal removal of deer by WS would not have an adverse impact on overall deer populations in Ohio, but some local reductions may occur. WS actions and all other take of deer in Ohio is regulated and monitored by the ODW, which is the agency with responsibility for managing wildlife in the state. No risk to public safety is expected when WS' services are provided and accepted by requesting individuals in Alternatives 1, 3, and 4 since only trained and experienced WS personnel would conduct and recommend DDM activities. There would be a slight increased risk to public safety when a person rejects WS assistance and recommendations in Alternatives 1, 3, and 4. Risks would likely still be low but would highest under Alternative 2 when no assistance would be available from WS,

Under Alternative 2, management actions taken by non-federal entities would be considered the *environmental status quo*. In those situations where a non-federal cooperator has already made the decision to remove or otherwise manage white-tailed deer to stop damage with or without WS assistance, WS participation in carrying out the action will not affect the *environmental status quo*. In some situations, dependent upon the skills and abilities of the non-federal entity, WS involvement may actually have a *beneficial* effect on the human environment when compared to the *environmental status quo* in the absence of such involvement.

Although some persons will likely be opposed to WS' participation in DDM activities, the analysis in this EA indicates that WS IWDM program will not result in significant, cumulative, adverse impacts on the quality of the human environment.

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APPENDIX A

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APPENDIX B

WHITE-TAILED DEER DAMAGE MANAGEMENT METHODS RECOMMENDED OR AUTHORIZED FOR USE BY THE OHIO WILDLIFE SERVICES PROGRAM

NONLETHAL METHODS

Resource Management

These consist primarily of non-lethal preventive methods such as cultural methods and habitat modification that are implemented by the affected resource owner/manager. Resource owners/managers may be encouraged to use these methods, based on the level of risk, need, and professional judgment on their effectiveness and practicality. These methods include:

Changes in human behavior

These may include altering the flight times of departing and arriving aircraft so that flying is at a time period of low wildlife activity. This may include restricting flying during certain times of the day or restricting departures and arrivals on specific runways.

Habitat modification

Habitat modification can be an integral part of WDM. Wildlife production and/or presence are directly related to the type, quality and quantity of suitable habitat. Therefore, habitat can be managed to reduce or eliminate the production or attraction of certain wildlife species. The resource/property owner is responsible for implementing habitat modifications, and WS only provides advice on the type of modifications that have the best chance of achieving the desired effect. Habitat management is most often a primary component of WDM strategies at or near airports to reduce problems by eliminating loafing, bedding and feeding sites. Generally, many problems on airport properties can be minimized through management of vegetation and water on areas adjacent to aircraft runways.

Modifying or eliminating habitat utilized by deer may change deer behavior and reduce some deer-human conflicts. This could include reducing vegetative cover and forage plants used or preferred by deer. One method, to eliminate habitat, is using cattle to consume the biomass that deer and other wildlife would feed upon. Reardon and Merrill report that continuous heavy grazing by cattle or by mixed classes of livestock eliminated preferred deer foods and adversely impacts other aspects of white-tailed deer habitat (Reardon and Merrill 1978, Merrill et al. 1957, Merrill 1959). Crawford noted that livestock grazing affects the vigor and composition of plants and the direction and rapidity of plant succession. Thus, it can significantly influence carrying capacity of white-tailed deer habit (Crawford 1984).

Studies in agriculture areas of Missouri indicate cultivated crops comprised 41 percent of deer diet by volume (Beringer J. and Hansen L. P. 1997). Thus, by reducing the amount of deer preferred crops, deer densities in an area (i.e. airport runways) may decrease. For example, brome grass could be chosen to replace row crops, as brome is not a highly preferred plant species by deer, relative to other cover crops (i.e. alfalfa and clover) and still provides the owner with a source of revenue.

Physical Exclusion

A fence can limit the entry of deer onto affected properties. There are several types of fences that inhibit the movement of deer if properly installed, including electric fencing, woven wire, and chain link fencing. The height of a fence required to exclude deer is a much debated topic. Smith and Coggin (1984) reported that a 7-foot fence (2.1-meters) reduced deer-vehicle collisions by 44.3 to 83.9 percent along a New York Thruway. Clearly and Dolbeer (1999) recommend that airports install a 10-foot chain link fence with barbed-wire outriggers to limit deer entry. For the purpose of this EA, WS recommends a fence height of 12 feet, with an additional three feet buried below the ground, to exclude deer. However, other permanent fencing heights from 8 to 10 ft can be utilized and are effective (VerCauteren et al. 2006). Other types of non-permanent fencing can be utilized and are effective when deer tolerance is low. Examples are high tensile electric fencing at a height of 5 ft as well as slanted configurations that give a 3-dimentinal apperance which makes the jump look higher or longer (VerCauteren et al. 2006).

Behavior Modification

This refers to tactics that alter the behavior of wildlife to reduce damage. Effective behavior modification usually requires integrating two or more auditory scaring or visual scaring techniques.

Auditory scaring techniques

The proper use of frightening devices and harassment techniques including sirens, flashing lights, electronic distress sounds, pyrotechnics, propane exploders, dogs, and rubber projectiles fired from a shotgun could help reduce conflicts (Craven and Hygnstrom 1994). Used in the proper context, these devices can help keep deer away from conflict areas. Some disadvantages are that these methods can be labor intensive and expensive. Also, frightening methods must be continued indefinitely unless the deer population is reduced or excluded from the resource.

Pyrotechnics: Pyrotechnics are specialized fireworks that are shot out of a 12-gauge shotgun or starter's pistol to deter deer or other wildlife. To be successful, pyrotechnics should be carried by wildlife control personnel at all times and used whenever the situation warrants. Continued use of pyrotechnics, alone may lessen the effectiveness.

Propane Cannons: Propane cannons are mechanical devices that use propane gas and an igniter to produce a loud explosive sound. Propane cannons are often suggested as effective frightening agents for deer (Craven and Hygnstrom 1994),

and have been used frequently in attempts to reduce crop damage and encroachment on airports. Research has shown that propane cannons detonated systematically at 8-10 minute intervals are effective in frightening deer away from protected areas for two days. Motion-activated cannons however, detonate only when deer approach the area to be protected and have been shown to be effective up to 6 weeks. (Belant et al. 1996).

Visual scaring techniques

Visual techniques such as use of mylar tape (highly reflective surface produces flashes of light), eye-spot balloons (the large eyes supposedly give deer a visual cue that a large predator is present), flags, effigies (scarecrows), sometimes are effective in reducing deer damage in a localized area for a limited time period. Deer resistant cattle feeders, which use reflective tape and motion have also been developed to deter deer from locations where cattle are feeding (Seward et al. 2007). This technique was effective in reducing deer intrusions to feeders in early weeks. However, more frequent intrusions occurred in later weeks and some cattle were also deterred from feeding at cattle feeders due to the scaring device (Seward et al. 2007).

Repellents

Repellents have had mixed results in reducing deer damage to shrubs and trees (Palmer et al. 1983, Matschke et al. 1984, Conover 1984, Hygnstrom and Craven 1988, Andelt et al. 1991, Craven and Hygnstrom 1994). Field studies using the repellants Plantskydd and Liquid Fence to deter deer from game bird food plots also showed mixed results. Most of the pen-fed white-tailed deer avoided the Plantskydd treated milo in favor of the untreated milo (Arjo et al. 2005). More Liquid Fence treated milo was consumed than the Plantskydd, but it was still not preferred over the control milo (Arjo et al. 2005). Neither product was shown to reduce deer damage in the field (Arjo et al. 2005). Results are generally linked to deer numbers, availability of preferred food plant species, alternate food sources, season, and weather. Commercial repellents are costly ranging from $20/gallon to $80/gallon.

Repellents require continuous applications and are limited in their effectiveness. The effectiveness of a topical repellent is directly related to residue present on the plant. Rain, heavy dew and watering will remove the residue requiring reapplication of the material. The use of repellents can cause a decrease in native vegetation by shifting browsing pressure from protected plants to native flora. The effectiveness of repellents decreases as deer numbers increase and available food plants decrease.

Live-Capture/Trapping

Capture methods for deer include: clover traps, box traps, drop nets, and rocket nets. Captured deer may be used for research with relocation, movement studies, and sampling for disease surveillance.

Numerous studies have shown that live-capture and relocation of deer is relatively expensive, time-consuming and inefficient (Ishmael and Rongstad 1984, O'Bryan and McCullough 1985, Diehl 1988, Jones and Witham 1990, Ishmael et al. 1995). Additionally, relocation frequently results in high mortality rates for deer (Cromwell et. al. 1999, O'Bryan and McCullough 1985, Jones and Witham 1990, Ishmael et. al. 1995). Deer frequently experience physiological trauma during capture and transportation, (capture myopathy) and deer mortality after relocation, from a wide range of causes within the first year, has ranged from 25-89% (Jones and Witham 1990, Mayer et al. 1993). O'Bryan and McCullough (1985) found that only 15% of radio-collared black-tailed deer that were live-captured and relocated from Angel Island, California, survived for one year after relocation. Although relocated deer usually do not return to their location of capture, some do settle in familiar suburban habitats and create nuisance problems for those communities (Bryant and Ishmael 1991).

Chemical Immobilization

Capture methods for deer include: darting with capture drugs.
Captured deer may be used for research with relocation, movement studies, and sampling for disease surveillance.

Capturing deer using immobilization drugs also requires knowledge of withdrawal periods, especially when chemical immobilization is used in close proximity to harvest seasons when deer may be consumed by humans. Depending on the immobilization drug withdrawal times vary and hunting/harvest seasons should be considered before application. The following are immobilizing/euthanasia drugs that could be used to capture deer:

Ketamine (Ketamine HCl) is a dissociative anesthetic that is used to capture wildlife, primarily mammals, birds, and reptiles. It is used to eliminate pain, calms fear, and allay anxiety. Ketamine is possibly the most versatile drug for chemical capture, and it has a wide safety margin (Fowler and Miller 1999). When used alone, this drug may produce muscle tension, resulting in shaking, staring, increased body heat, and, on occasion, seizures. Usually, ketamine is combined with other drugs such as xylazine. The combination of such drugs is used to control an animal, maximize the reduction of stress and pain, and increase human and animal safety.

Telazol (tiletamine) is another anesthetic used in wildlife capture. It is 2.5 to 5 times more potent than ketamine; therefore, it generally works faster and lasts longer. Currently, tiletamine can only be purchased as Telazol, which is a mixture of two drugs: tiletamine and zolazepam (a tranquilizer). Muscle tension varies with species. Telazol produces extensive muscle tension in dogs, but produces a more relaxed anesthesia in coyotes, wolves, and bears. It is often the drug of choice for these wild species (Fowler and Miller 1999). This drug is sold in a powder form and must be reconstituted with sterile water before use. Once mixed with sterile water, the shelf life is four days at room temperature and 14 days if refrigerated.

Xylazine is a sedative (analgesic) that calms nervousness, irritability, and excitement, usually by depressing the central nervous system. Xylazine is commonly used with ketamine to produce a relaxed anesthesia. It can also be used alone to facilitate physical restraint. Because xylazine is not an anesthetic, sedated animals are usually responsive to stimuli. Therefore, personnel should be even more attentive to minimizing sight, sound, and touch. When using ketamine/xylazine combinations, xylazine will usually overcome the tension produced by ketamine, resulting in a relaxed, anesthetized animal (Fowler and Miller 1999). This reduces heat production from muscle tension, but can lead to lower body temperatures when working in cold conditions.

Dogs

Domestic dogs have been used to harass deer from agricultural crops (Vercauteren et al. 2005). Efficacy of dogs was evaluated over a several year period. Crop damage prior to use of dogs was estimated at 4,391 in 1999 and after implementation of dogs in 2001-2002 no crop damage occurred in fields protected by the dogs (Vercauteren et al. 2005). Use of dogs was also compared to use of a double stranded electric polytape fence. In 2001-2002 the fields dogs were used in experienced no losses, but $3,797 and $638 was estimated to be lost in fields protected with electric polytape (Vercauteren et al. 2005). Although, dogs proved to be useful in protecting crops the study used 6 different dogs before researchers found a dog that would actively patrol the area (Vercauteren et al. 2005). There are also costs associated with using dogs, which ranges from rotation of dog stock, food, veterinarian care, and invisible fencing to contain the dogs. (Vercauteren et al. 2005).

Use of livestock protection dogs also have potential to decrease deer intrusions away from livestock feeding areas, where disease transmission between livestock and deer could occur.
(http://www.aphis.usda.gov/ws/nwrc/is/Accomplishments_2005.pdf)

LETHAL METHODS

Sharpshooting

Studies have suggested that localized management by removing deer is an effective tool where deer are causing undesirable effects (McNutly et al.1997). This research supports the hypothesis that the removal of a small, localized group of white-tailed deer would create a population of low density in that localized area.

Wildlife Services would conduct sharpshooting, with center-fire rifles, during daylight or at night using spotlights or night-vision equipment. Rifles would be equipped with sound suppressors, to avoid disturbance, and to facilitate success by minimizing the tendency of deer to flee from the sound of gunfire. Shots would be taken from elevated positions in tree stands, in the beds of trucks, or other vantage points. Elevated positions cause a downward angle of trajectory, so that any bullets that inadvertently miss or pass through

targeted deer, will hit into the ground or into earthen embankments to minimize the risk of stray bullets presenting a safety hazard to people, pets, or property. Wildlife Services personnel would strive for head and neck shots when shooting deer to achieve quick, humane kills. Bait may be used to attract deer to safe sites for shooting and to enhance success and efficiency. The venison from deer killed by WS would be, when possible, processed and donated for consumption, at one or more charitable organizations. Wildlife Services will be responsible for properly preparing deer and the delivery to a USDA approved meat processor.

Only WS personnel, who have completed firearms safety training, have demonstrated skill and proficiency with the firearms used for deer removal, and have been approved for sharpshooting by the Ohio State Director will participate in sharpshooting deer.

Firearm use is very sensitive and a public concern because of safety issues relating to the public and misuse. To ensure safe use and awareness, WS employees who use firearms to conduct official duties are required to attend an approved firearms safety-and-use training program within three months of their appointment and a refresher course every two years afterwards (WS Directive 2.615). Wildlife Services employees, who carry firearms as a condition of employment, are required to sign a form certifying that they meet the criteria as stated in the *Lautenberg Amendment* which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

Live Capture and Euthanasia

Some situations restrict or do not warrant standard shooting operations. In such cases it may be appropriate to remove individual deer by trapping and euthanizing the animals. Clover traps, box traps, drop nets, and rocket nets are several methods that can be used to live capture deer. Captured deer would be euthanized by methods recommended by the AVMA (Beaver et al. 2001) or per the recommendations of a veterinarian.

It is also possible to live capture deer using chemical immobilization drugs (see Chemical Immobilization section). Deer that are immobilized would be subsequently euthanized. The following is and example of a euthanasia drug that is commonly used to euthanize deer:

Sodium Pentobarbital is a barbiturate that rapidly depresses the central nervous system to the point of respiratory arrest. There are DEA restrictions on who can possess and administer this drug. Some states may have additional requirements for personnel training and particular sodium pentobarbital products available for use in wildlife. Certified WS personnel are authorized to use sodium pentobarbital and dilutions for euthanasia in accordance with DEA and state regulations.

Hunting Programs

WS may recommend white-tail deer hunting as a viable damage management method when deer can be legally hunted. A valid hunting license and other licenses or permits may be required by the ODW. This method provides sport and food for hunters and requires no cost to the landowner.

APPENDIX C

FEDERALLY ENDANGERED, THREATENED, PROPOSED, AND CANDIDATE SPECIES IN OHIO

Animals

Myotis sodalis	Indiana bat (E)*
Haliaeetus leucocephalus	Bald Eagle (T)*
Charadrius melodus	Piping Plover (E)*
Noturus trautmani	Scioto madtom (E)*
Epioblasma obliquata obliquata	Purple cat's paw pearly mussel (E)*
Epioblasma torulosa rangiana	Northeren riffle (E)*
Cyprogenia stegaria	Fanshell (E)*
Pleurobema clava	Clubshell (E)*
Epioblasma obliquata perobliqua	White cat's paw pearly mussel (E)*
Lampsilis abrupta	Pink mucket pearly mussel (E)*
Villosa fabalis	Rayed bean (C)*
Plethobasus cyphyus	Sheepnose (C)*
Nicrophorus americanus	American burying beetle (E)*
Neonympha m. mitchelli	Mitchell's satyr (E)*
Lycaiedes melissa samuelis	Karner blue butterfly (E)*
Nerodia sipedon insularim	Lake Erie watersnake (T)*
Nerodia erythrogastor neglecta	Copperbelly watersnake (T)*
Sistrurus catenatus	Eastern massasauga (C)*
Crotalus horridus horridus	Timber rattlesnake (PC)*

Plants

Trifolium stoloniferum	Running buffalo clover (E)*
Hymenoxys herbacea	Lakeside daisy (T)*
Aconitum noveboracense	Northern monkshood (T)*
Platanthera leucophaea	Eastern prairie fringed orchid (T)*
Spiraea virginiana	Virginia spiraea (T)*
Isotria medeoloides	Small whorled pogonia (T)*

APPENDIX D

SPECIES THAT ARE LISTED AS ENDANGERED AND THREATENED BY THE STATE OF OHIO

MAMMALS

Endangered

Myotis sodalis……Indiana bat
Neotoma magister.....Allegheny woodrat
Lynx rufus…… Bobcat
Ursus americanus……...Black bear
Lepus americanus…… Snowshoe hare

BIRDS

Endangered

Botaurus lentiginosus……...American Bittern
Circus cyaneus……...Northern Harrier
Rallus elegans……...King Rail
Grus canadensis……Sandhill Crane
Charadrius melodus……..Piping Plover
Sterna hirundo……...Common Tern
Chlidonias niger……...Black Tern
Sphyrapicus varius……...Yellow-bellied Sapsucker
Thryomanes bewickii……...Bewick's Wren
Lanius ludovicianus……..Loggerhead Shrike
Vermivora chrysoptera……Golden-winged Warbler
Dendroica kirtlandii……Kirtland's Warbler
Chondestes grammacus……...Lark Sparrow
Cygnus buccinator……...Trumpeter Swan
Egretta thula……..Snowy Egret
Bubulcus ibis……Cattle Egret

Threatened

Bartramia longicauda……Upland sandpiper
Nycticorax nycticorax……Black-crowned Night-heron
Nyctanassa violacea……...Yellow-crowned Night-heron
Tyto alba……...Barn Owl
Junco hyemalis……...Dark-eyed Junco
Catharus guttatus……...Hermit Thrush
Ixobrychus exilis……Least Bittern
Empidonax minimus……..Least Flycatcher
Falco peregrinus……...Peregrine Falcon
Pandion haliaetus……Osprey

AMPHIBIANS AND REPTILES

Endangered

Cryptobranchus alleganiensis allegani……Eastern hellbender
Ambystoma laterale……...Blue spotted salamander

Aneides aeneus……..Green salamander
Eurycea lucifuga……Cave salamander
Scaphiopus holbrookii……...Eastern spadefoot
Nerodia erythrogaster neglecta……Copperbelly water snake
Thamnophis radix radi.……Eastern plains garter snake
Crotalus horridus horridus.……..Timber rattlesnake
Nerodia sipedon insularum.……..Lake Erie water snake
Sistrurus catenatus…….Eastern Massasauga

Threatened

Pseudotriton montanus.……Mud salamander
Clonophis kirtlandii.……..Kirtland's snake

Clemmys guttata……Spotted turtle

FISH

Threatened

Salvelinus fontinalis……Brook trout
Notropis boops……Bigeye shiner
Exoglossum laurae……..Tonguetied minnow
Moxostoma valenciennesi……Greater redhorse
Percina copelandi……Channel darter
Anguilla rostrata……..American eel
Clinostomus funduloides……..Rosyside dace
Notropis dorsalis……..Bigmouth shiner
Erimyzon sucetta……..Lake chubsucker
Percina shumardi…….River darter
Etheostoma camurum……..Bluebreast darter
Etheostoma tippecanoe…….....Tippecanoe darter
Polyodon spathula.....Paddlefish

Endangered

Ichthyomyzon bdellium……Ohio lamprey
Ichthyomyzon fossor……Northern brook lamprey
Ichthyomyzon greeleyi…….Mountain brook lamprey
Acipenser fulvescens……Lake sturgeon
Scaphirhynchus platorynchus……..Shovelnose sturgeon
Lepisosteus oculatus……Spotted gar
Lepisosteus platostomus……..Shortnose gar
Coregonus artedi…….Cisco (or Lake herring)
Hiodon alosoides…….Goldeye
Macrhybopsis aestivalis……..Speckled chub
Opsopoeodus emiliae……..Pugnose minnow
Notropis ariomus……Popeye shiner
Notropis heterodon…….Blackchin shiner
Notropis heterolepis……Blacknose shiner
Hybognathus nuchalis……Mississippi silvery minnow
Cycleptus elongates……Blue sucker

Catostomus catostomus……..Longnose sucker
Noturus eleutherus…….Mountain madtom
Noturus stigmosus……..Northern madtom
Noturus trautmani……..Scioto madtom
Aphredoderus sayanus……...Pirate perch
Fundulus diaphanus menona…….Western banded killifish
Etheostoma maculatum……..Spotted darter

MOLLUSKS

Endangered

Epioblasma triquetra……..Snuffbox
Fusconaia ebena…….Ebonyshell
Cyprogenia stegaria……...Fanshell
Ellipsaria lineolata…….Butterfly
Elliptio crassidens crassidens……Elephant-ear
Epioblasma o. obliquata……Purple catspaw
Epioblasma obliquata perobliqua…….White catspaw
Epioblasma torulosa rangiana……..Northern riffleshell
Fusconaia maculata maculata……..Long-solid
Lampsilis orbiculata……..Pink mucket
Lampsilis ovata…….Sharp-ridged pocketbook
Lampsilis teres……..Yellow sandshell
Ligumia nasuta……..Eastern pondmussel
Megalonaias nervosa……Washboard
Plethobasus cyphyus……..Sheepnose
Pleurobema clava……..Clubshell
Pleurobema cordatum……Ohio pigtoe
Pleurobema rubrum……Pyramid pigtoe
Quadrula cylindrica cylindrical…….Rabbitsfoot
Quadrula metanevra……..Monkeyface
Quadrula nodulata…….Wartyback
Toxolasma lividus……...Purple lilliput
Villosa fabalis…….Rayed bean
Villosa lienosa……Little spectaclecase

Threatened

Ligumia recta……....Black sandshell
Obliquaria reflexa…….Threehorn wartyback
Truncilla donaciformis……Fawnsfoot
Unimerus tetralasmus……...Pondhorn

BUTTERFLIES AND MOTHS

Endangered

Erynnis persius…….Persius dusky wing
Incisalia irus……..Frosted elfin
Lycaeides melissa samuelis……..Karner blue
Lycaena helloides…….Purplish copper
Calephelis muticum……..Swamp metalmark
Speyeria idalia……Regal fritillary
Pyrgus cantaureae wyandot……Grizzled skipper
Neonympha mitchellii……..Mitchell's satyr

Cycnia inopinatus……Unexpected cycnia
Catocala gracilis……Graceful underwing
Spartiniphaga inops
Hypocoena enervata
Papaipema silphii
Papaipema beeriana
Lithophane semiusta
Trichoclea artesta
Tricholita notata
Melanchra assimilis
Epiglaea apiata……..Pointed sallow
Ufeus plicatus
Ufeus satyricus
Erythroecia hebardi……Hebard's noctuid moth

Threatened

Boloria selene……..Silver-bordered fritillary

Catocala antinympha……...Wayward nymph
Spartiniphaga panatela
Fagitana littera
Faronta rubripennis……The pink-streak

CADDISFLIES

Endangered

Chimarra socia
Oecetis eddlestoni
Brachycentrus numerosus

Threatened

Psilotreta indecisa
Hydroptila albicornis
Hydroptila artesa
Hydroptila koryaki
Hydroptila talledaga
Hydroptila valhalla

BEETLES

Endangered

Pseudanophthalmus krameri……Kramer's cave beetle
Pseudanophthalmus ohioensis…….Ohio cave beetle
Nicrophorus americanus……..American burying beetle

Threatened

Cicindela hirticollis
Cicindela marginipennis……Cobblestone tiger beetle

CRAYFISHES

Threatened
Orconectes sloanii……Sloan's crayfish

Cambarus robustus…….. Cavespring crayfish

DRAGONFLIES

Endangered
Somatochlora hineana…….Hine's emerald
Aeshna clepsydra…….Mottled darner
Gomphus externus……Plains clubtail
Cordulia shurtleffi……American emerald
Helocordulia uhleri……..Uhler's sundragon
Leucorrhinia frigida…….Frosted whiteface
Nannothemis bella……Elfin skimmer
Aeshna Canadensis……..Canada darner
Dorocordulia libera…….Racket-tailed emerald
Somatochlora walshii……..Brush-tipped emerald
Ladona deplanata……Blue corporal
Ladona julia……Chalk-fronted corpora
Libellula flavida……..Yellow-sided skimmer

Threatened
Ophiogomphus carolus……Riffle snaketail
Gomphaeschna furcillata…….Harlequin darner
Gomphus viridifrons……Green-faced clubtail
Enallagma boreale……Boreal bluet
Enallagma cyathigerum……Northern bluet
Enallagma erbium…….Marsh bluet

DAMSELFLIES

Endangered
Ischnura kellicott…….. Lilypad forktail
Argia bipunctulata……..Seepage dancer
Calopteryx aequabilis…….River jewelwing

MAYFLIES

Endangered
Rhithrogena pellucida
Litobrancha recurvata

MIDGES

Endangered
Rheopelopia acra

Threatened
Bethbilbeckia floridensis
Apsectrotanypus johnsoni
Radotanypus florens

VASCULAR PLANTS

Endangered
Acer pensylvanicum…….....Striped Maple
Aconitum noveboracense…….Northern Monkshood
Aconitum uncinatum…….Southern Monkshood

Agalinis auriculata……...Ear-leaved-foxglove
Agalinis purpurea var. parviflora……Small Purple-foxglove
Agalinis skinneriana……Skinner's-foxglove
Agrostis elliottiana……..Elliott's Bent Grass
Amelanchier sanguinea……...Rock Serviceberry
Andropogon glomeratus……..Bushy Broom-sedge
Arabis divaricarpa……...Limestone Rock Cress
Arabis drummondii……..Drummond's Rock Cress
Arabis hirsuta var. pycnocarpa……...Western Hairy Rock Cress
Arabis missouriensis……Missouri Rock Cress
Arabis patens……...Spreading Rock Cress
Aralia hispida……..Bristly Sarsaparilla
Arethusa bulbosa……Dragon's-mouth
Aristida necopina……False Arrow-feather
Aronia arbutifolia…….....Red Chokeberry
Aster dumosus…….Bushy Aster
Aster surculosus……..Creeping Aster
Astragalus neglectus……...Cooper's Milk-vetch
Aureolaria pedicularia var. ambigens……Prairie Fern-leaved False Foxglove
Aureolaria pedicularia var. pedicularia……Woodland Fern-leaved False Foxglove
Baptisia australis……Blue False Indigo
Bartonia paniculata……Screw-stem
Botrychium lanceolatum…….Triangle Grape Fern
Botrychium multifidum……...Leathery Grape Fern
Botrychium simplex……Least Grape Fern
Campanula rotundifolia……Harebell
Cardamine pratensis var. palustris……..American Cuckoo-flower
Carex alopecoidea……Northern Fox Sedge
Carex arctata……Drooping Wood Sedge
Carex bushii…….Bush's Sedge
Carex decomposita……..Cypress-knee Sedge
Carex disperma……Two-seeded Sedge
Carex echinata…….Little Prickly Sedge
Carex garberi……..Garber's Sedge
Carex limosa……Mud Sedge
Carex longii…….Long's Sedge
Carex louisianica…….Louisiana Sedge
Carex lucorum…….Fire Sedge
Carex merritt-fernaldii……Fernald's Sedge
Carex mitchelliana……...Mitchell’s Sedge
Carex planispicata……..Flat-spiked Sedge
Carex pseudocyperus……Northern Bearded Sedge
Carex retrorsa……..Reflexed Bladder Sedge
Carex striatula…….Lined Sedge
Carex timida……Timid Sedge
Chrysopsis graminifolia……..Silk-grass
Cinna latifolia……..Northern Wood-reed
Clintonia borealis……Bluebead-lily
Coeloglossum viride…….Long-bracted Orchid
Collinsonia verticillata…….Early Stoneroot
Corallorhiza trifida……...Early Coral-root
Cornus canadensis……Bunchberry
Crataegus uniflora……Dwarf Hawthorn
Croton glandulosus……..Northern Croton
Cuscuta cuspidate……Cuspidate Dodder
Cuscuta indecora……..Pretty Dodder

Cyperus refractus…….Reflexed Umbrella-sedge
Cyperus retrofractus…….Rough Umbrella-sedge
Cypripedium candidum……White Lady's-slipper
Cypripedium parviflorum var. parviflorum…….Small Yellow Lady's-slipper
Dalibarda repens…….Robin-run-away
Desmodium glabellum…….Hairy Tick-trefoil
Draba brachycarpa……Little Whitlow-grass
Dryopteris celsa……Log Fern
Dryopteris clintoniana……..Clinton's Wood Fern
Dryopteris filix-mas……..Male Fern
Echinodorus berteroi…….Burhead
Eleocharis engelmannii…….Engelmann's Spike-rush
Eleocharis geniculata……Caribbean Spike-rush
Eleocharis ovata……....Ovate Spike-rush
Eleocharis parvula……Least Spike-rush
Eleocharis quinqueflora…….Few-flowered Spike-rush
Eleocharis robbinsii……...Robbins' Spike-rush
Eleocharis wolfii……Wolf's Spike-rush
Epilobium angustifolium……Fireweed
Equisetum variegatum……Variegated Scouring-rush
Eriocaulon aquaticum……White-buttons
Erysimum arkansanum……Western Wallflower
Erythronium rostratum……...Golden-star
Eupatorium aromaticum……...Small White Snakeroot
Eupatorium hyssopifolium…….Hyssop Thoroughwort
Euphorbia purpurea……..Glade Spurge
Euphorbia serpens…….Round-leaved Spurge
Fallopia cilinodis……...Mountain Bindweed
Fissidens hyalinus……..Filmy Fissidens
Froelichia floridana……...Common Cottonweed
Galium palustre…….Marsh Bedstraw
Gentiana puberulenta…….Prairie Gentian
Gentiana saponaria……Soapwort Gentian
Gentiana villosa……..Sampson's Snakeroot
Geranium bicknellii…….Bicknell's Crane's-bill
Gnaphalium viscosum…….Winged Cudweed
Heteranthera reniformis…….Mud-plantain
Heuchera longiflora……...Long-flowered Alum-root
Hieracium longipilum……....Long-bearded Hawkweed
Hydrocotyle umbellate……...Navelwort
Hymenoxys herbacea……..Lakeside Daisy
Hypericum canadense…….Canada St. John's-wort
Hypericum denticulatum……....Coppery St. John's-wort
Hypericum gymnanthum…….Least St. John's-wort
Hypnum pretense……....Wrinkled-leaved Marsh Hypnum
Isoetes engelmannii……Appalachian Quillwort
Isotria medeoloides……Small Whorled Pogonia
Juncus diffusissimus……...Diffuse Rush
Juncus interior……Inland Rush
Juncus platyphyllus……....Flat-leaved Rush
Juniperus communis……..Ground Juniper
Koeleria macrantha……...June Grass
Lactuca hirsute……..Hairy Tall Lettuce
Lathyrus ochroleucus……Yellow Vetchling
Lathyrus venosus……...Wild Pea
Ledum groenlandicum……...Labrador-tea

Leersia lenticularis……Catchfly Grass
Linaria Canadensis……Old-field Toadflax
Lipocarpha drummondii……Drummond's Dwarf Bulrush
Magnolia macrophylla……...Bigleaf Magnolia
Minuartia patula……...Spreading Sandwort
Monarda punctata……..Dotted Horsemint
Moneses uniflora……One-flowered Wintergreen
Muhlenbergia cuspidate…….Plains Muhlenbergia
Muhlenbergia glabrifloris……...Hair Grass
Myrica pensylvanica……..Bayberry
Myriophyllum heterophyllum……Two-leaved Water-milfoil
Myriophyllum verticillatum ……..Green Water-milfoil
Najas gracillima ……....Thread-like Naiad
Nuphar variegate……...Bullhead-lily
Oenothera clelandii……Cleland's Evening-primrose
Ophioglossum engelmannii……Limestone Adder's-tongue
Ophioglossum pusillum…….Northern Adder's-tounge
Oryzopsis asperifolia…….Large-leaved Mountain-rice
Oxalis montana……White Wood-sorrel
Panicum commonsianum……...Commons' Panic Grass
Panicum perlongum……...Long-panicled Panic Grass
Panicum philadelphicum……Philadelphia Panic Grass
Panicum praecocius……...Early Panic Grass
Panicum scoparium…….Velvet Panic Grass
Panicum spretum…….Narrow-headed Panic Grass
Panicum villosissimum……...Villous Panic Grass
Panicum yadkinense……Spotted Panic Grass
Paxistima canbyi……Cliff-green
Penstemon laevigatus…….Smooth Beard-tongue
Persicaria setacea……. ……Bristly Smartweed
Phacelia dubia……...Small-flowered Scorpion-weed
Phacelia ranunculacea……..Blue Scorpion-weed
Phlox latifolia……Mountain Phlox
Phyllanthus caroliniensis……..Carolina Leaf-flower
Placidium lachneum……..Brown Stipplescale
Plantago cordata……...Heart-leaved Plantain
Plantago patagonica ……Woolly Plantain
Platanthera blephariglottis……...White Fringed Orchid
Platanthera psycodes…….Small Purple Fringed Orchid
Pluchea camphorate……..Camphor-weed
Poa saltuensis……Pasture Blue Grass
Poa wolfii……..Wolf's Blue Grass
Podostemum ceratophyllum……..Riverweed
Polygala cruciata…….Cross-leaved Milkwort
Polygala curtissii…….Curtiss' Milkwort
Polygala paucifolia……..Gay-wings
Populus balsamifera……Balsam Poplar
Potamogeton friesii……..Fries' Pondweed
Potamogeton gramineus……..Grass-like Pondweed
Potamogeton hillii……...Hill's Pondweed
Potamogeton praelongus……White-stemmed Pondweed
Potamogeton pulcher……..Spotted Pondweed
Potamogeton robbinsii……....Robbins' Pondweed
Potamogeton tennesseensis…….Tennessee Pondweed
Potentilla arguta…….Tall Cinquefoil
Potentilla paradoxa……Bushy Cinquefoil

Prenanthes trifoliolata……...Gall-of-the-earth
Prunus mexicana……Bigtree Plum
Pteridium aquilinum var. pseudocaudatum……Tailed Bracken
Pycnanthemum verticillatum var. pilosum……Hairy Mountain-mint
Pyrola chlorantha……...Green-flowered Wintergreen
Ramalina intermedia……...Rock Ramalina
Ramalina pollinaria……Chalky Ramalina
Ranunculus pusillus……Low Spearwort
Rhododendron calendulaceum……Flame Azalea
Rhododendron nudiflorum var. nudiflorum……Pinxter-flower
Rhynchospora recognita……..Tall Grass-like Beak-rush
Ribes triste……...Swamp Red Currant
Rosa blanda……Smooth Rose
Rubus trivalis……...Southern Dewberry
Saccharum alopecuroideum……Silver Plume Grass
Sagina decumbens……Southern Pearlwort
Sagittaria graminea……Grass-leaved Arrowhead
Salix pedicellaris……Bog Willow
Scheuchzeria palustris……Scheuchzeria
Schizachne purpurascens……False Melic
Schizachyrium littorale……Coastal Little Bluestem
Schoenoplectus americanus……Olney's Three-square
Schoenoplectus smithii……Smith's Bulrush
Schoenoplectus subterminalis……..Swaying-rush
Schoenoplectus torreyi……Torrey's Bulrush
Scleria oligantha……..Tubercled Nut-rush
Silene nivea……..Snowy Campion
Silphium laciniatum……Compass-plant
Sisyrinchium atlanticum……..Atlantic Blue-eyed-grass
Sisyrinchium mucronatum……...Narrow-leaved Blue-eyed-grass
Smilax pulverulenta……Downy Carrion-flower
Solidago puberula……...Dusty Goldenrod
Solidago sphacelata……False Goldenrod
Sorbus decora……Western Mountain-ash
Sparganium emersum……..Small Bur-reed
Spiraea virginiana……..Appalachian Spiraea
Spiranthes romanzoffiana……...Hooded Ladies'-tresses
Streptopus lanceolatus……Rose Twisted-stalk
Tortella inclinata……Curved Tortella
Toxicodendron rydbergii……Northern Poison-ivy
Triadenum walteri……..Walter's St. John's-wort
Trichomanes boschianum……...Appalachian Filmy Fern
Trichostema dichotomum var. lineare……Narrow-leaved Bluecurls
Trifolium reflexum……..Buffalo Clover
Trifolium stoloniferum……Running Buffalo Clover
Trillium undulatum……Painted Trillium
Trollius laxus……..Spreading Globeflower
Urtica chamaedryoides……..Spring Nettle
Utricularia cornuta……...Horned Bladderwort
Utricularia geminiscapa……....Two-scaped Bladderwort
Vaccinium myrtilloides……..Velvet-leaved Blueberry
Valeriana ciliata……....Prairie Valerian
Verbesina occidentalis……..Yellow Crown-beard
Vernonia missurica……...Missouri Ironweed
Viburnum opulus var. americanum……..Highbush-cranberry
Viola missouriensis……..Missouri Violet

Viola nephrophylla……...Northern Bog Violet
Viola pedatifida……Prairie Violet
Viola primulifolia…….Primrose-leaved Violet
Viola tripartita var. glaberrima……..Wedge-leaved Violet
Viola walteri……Walter's Violet
Xyris difformis…….Variable Yellow-eyed-grass

VASCULAR PLANTS

Threatened
Actaea rubra……...Red Baneberry
Adlumia fungosa…….Mountain-fringe
Agalinis gattingeri……..Gattinger's-foxglove
Ammophila breviligulata……American Beach Grass
Androsace occidentalis……..Western Rock-jasmine
Anemone cylindrica……....Prairie Thimbleweed

Antennaria virginica……..Shale Barren Pussy-toes
Apocynum sibiricum……..Clasping-leaved Dogbane
Arabis lyrata……..Lyre-leaved Rock Cress
Armoracia lacustris……...Lake Cress
Artemisia campestris…….Beach Wormwood
Asclepias variegate……....White Milkweed
Asplenium bradleyi……Bradley's Spleenwort
Asplenium ruta-muraria……Wall-rue
Aster drummondii……..Drummond's Aster
Aster oblongifolius……Shale Barren Aster
Aster solidagineus…….Narrow-leaved Aster
Astragalus canadensis……..Canada Milk-vetch
Betula pumila……Swamp Birch
Botrychium biternatum……....Sparse-lobed Grape Fern
Brachyelytrum aristosum……..Bearded Shorthusk
Buchnera americana…….Bluehearts
Calamagrostis porteri ssp. insperata……Bartley's Reed Grass
Calamintha arkansana……..Limestone Savory
Calla palustris……...Wild Calla
Callitriche verna……Vernal Water-starwort
Calopogon tuberosus…….Grass-pink
Carex albolutescens……...Pale Straw Sedge
Carex appalachica…….Appalachian Sedge
Carex atlantica ssp. capillacea……...Howe's Sedge
Carex aurea……Golden-fruited Sedge
Carex bicknellii……..Bicknell's Sedge
Carex brevior…….Tufted Fescue Sedge
Carex brunnescens…….Brownish Sedge
Carex cephaloidea……..Thin-leaved Sedge
Carex conoidea……..Field Sedge
Carex crinita var. brevicrinis…….....Short-fringed Sedge
Carex lupuliformis…….False Hop Sedge
Carex mesochorea…….Midland Sedge
Carex oligosperma…….Few-seeded Sedge
Carex pallescens……....Pale Sedge
Carex projecta……...Necklace Sedge
Carex purpurifera……..Purple Wood Sedge
Carex retroflexa…….Reflexed Sedge
Carex siccata…….....Hay Sedge
Carex sprengelii……....Sprengel's Sedge

Celtis tenuifolia…….Dwarf Hackberry
Chimaphila umbellata……...Pipsissewa
Chionanthus virginicus……...Fringe-tree
Chrysogonum virginianum……...Golden-knees
Cirsium carolinianum……...Carolina Thistle
Clintonia umbellulata……Speckled Wood-lily
Comptonia peregrina…….Sweet-fern
Conyza ramosissima……..Bushy Horseweed
Cuscuta glomerata……Glomerate Dodder
Cuscuta pentagona……Five-angled Dodder
Cyperus acuminatus……..Pale Umbrella-sedge
Cyperus schweinitzii…….Schweinitz' Umbrella-sedge
Cypripedium reginae……Showy Lady's-slipper
Deschampsia flexuosa……..Crinkled Hair Grass
Descurainia pinnata…….Tansy Mustard
Desmodium sessilifolium……..Sessile Tick-trefoil
Draba cuneifolia……...Wedge-leaved Whitlow-grass
Draba reptans……Carolina Whitlow-grass
Drosera intermedia…….Spathulate-leaved Sundew
Eleocharis compressa……Flat-stemmed Spike-rush
Eleocharis flavescens……Green Spike-rush
Eleocharis quinqueflora…….Few-flowered Spike-rush
Elymus trachycaulus……..Bearded Wheat Grass
Epilobium strictum…….Simple Willow-herb
Equisetum sylvaticum……Woodland Horsetail
Eryngium yuccifolium……...Rattlesnake-master
Eupatorium album……White Thoroughwort
Euthamia remota……...Great Lakes Goldenrod
Galactia volubilis……..Milk-pea
Galium labradoricum…….Bog Bedstraw
Gentiana alba……Yellowish Gentian
Glyceria acutiflora…….Sharp-glumed Manna Grass
Gratiola viscidula……..Short's Hedge-hyssop
Gymnocarpium dryopteris……Common Oak Fern
Helianthemum bicknellii……Plains Frostweed
Helianthemum canadense…….Canada Frostweed
Helianthus mollis……..Ashy Sunflower
Heuchera parviflora…….Small-flowered Alum-root
Heuchera villosa……..Hairy Alum-root
Hexalectris spicata……...Crested Coral-root
Hieracium canadense……...Canada Hawkweed
Hypericum boreale……...Northern St. John's-wort
Hypericum ellipticum……...Few-flowered St. John's-wort
Hypericum kalmianum……...Kalm's St. John's-wort
Iris brevicaulis……..Leafy Blue Flag
Iris verna……...Dwarf Iris
Juncus greenei……..Greene’s Rush
Juncus secundus……...One-sided Rush
Krigia dandelion……..Potato-dandelion
Krigia virginica……...Virginia Dwarf-dandelion
Lathyrus japonicus……...Inland Beach Pea
Lathyrus ochroleucus……..Yellow Vetchling
Leavenworthia uniflora……...Michaux's Leavenworthia
Lechea minor……...Thyme-leaved Pinweed
Lechea pulchella……..Leggett's Pinweed
Liatris cylindracea……..Slender Blazing-star

Lilium philadelphicum……Wood Lily
Lipocarpha micrantha……Dwarf Bulrush
Lithospermum caroliniense……Plains Puccoon
Luzula bulbosa……Southern Woodrush
Magnolia tripetala……Umbrella Magnolia
Manfreda virginica……American Aloe
Melampyrum lineare……Cow-wheat
Melanthium virginicum……Bunchflower
Melanthium woodii……Wood's-hellebore
Melica nitens……Three-flowered Melic
Menyanthes trifoliata……Buckbean
Myriophyllum sibiricum……American Water-milfoil
Nothoscordum bivalve……False Garlic
Orbexilum pedunculatum……False Scurf-pea
Panicum bicknellii……Bicknell's Panic Grass
Panicum leibergii……Leiberg's Panic Grass
Panicum lindheimeri……Lindheimer's Panic Grass
Panicum meridionale……Southern Hairy Panic Grass
Panicum tuckermanii……Tuckerman's Panic Grass
Panicum verrucosum……Warty Panic Grass
Passiflora incarnata……Maypop
Penstemon canescens……Gray Beard-tongue
Penstemon pallidus……Downy White Beard-tongue
Persicaria robustior……Course Smartweed
Plagiothecium latebricola……Lurking Leskea
Platanthera ciliaris……Yellow Fringed Orchid
Platanthera leucophaea……Prairie Fringed Orchid
Pleopeltis polypodioides……Little Gray Polypody
Pogonia ophioglossoides……Rose Pogonia
Polygala incarnata……Pink Milkwort
Polygala polygama……Racemed Milkwort
Potentilla palustris……Marsh Five-finger
Prenanthes aspera……Rough Rattlesnake-root
Prenanthes racemosa……Prairie Rattlesnake-root
Prosartes maculata……Nodding Mandarin
Prunus pumila ssp. cuneata……Sand Cherry
Quercus falcate……Spanish Oak
Ramalina petrina……Appalachian Trail Ramalina
Rhododendron maximum……Great Rhododendron
Ribes missouriense……Missouri Gooseberry
Sagittaria cuneata……Wapato
Salix candida……Hoary Willow
Salix petiolaris……Slender Willow
Senecio pauperculus……Balsam Squaw-weed
Silene caroliniana ssp. pensylvanica……Carolina Catchfly
Silene caroliniana ssp. wherryi……Wherry's Catchfly
Silene regia……Royal Catchfly
Sisyrinchium montanum……Northern Blue-eyed-grass
Solidago odora……Sweet Goldenrod
Solidago squarrosa……Leafy Goldenrod
Sparganium androcladum……Keeled Bur-reed
Sphenopholis obtusata var. obtusata……Prairie Wedge Grass
Sporobolus heterolepis……Prairie Dropseed
Stipa spartea……Porcupine Grass
Tofieldia glutinosa……False Asphodel
Triadenum tubulosum……Large Marsh St. John's-wort

Triglochin maritimum…….Seaside Arrow-grass
Trillium recurvatum……Prairie Wake-robin
Ulmus thomasii……...Rock Elm
Utricularia intermedia……Flat-leaved Bladderwort
Vaccinium oxycoccos…….Small Cranberry
Viburnum molle……..Soft-leaved Arrow-wood
Viola pedata……...Birdfoot Violet
Wolffiella gladiata……..Wolffiella
Xyris torta.……...Twisted Yellow-eyed-grass
Zizania aquatica…….Wild Rice

LICHENS

Endangered

Canoparmeila amabilis.……...Obed Shield Lichen
Canoparmelia caroliniana……...Carolina Shield Lichen
Collema bachmanianum.……Bachman's Jelly Lichen
Collema coccophorum……Tar Jelly Lichen
Collema conglomeratum……..Dotted Jelly Lichen
Collema fuscovirens…….Dusky Jelly Lichen
Parmotrema madagascariaceum…….Madagascar Ruffle Lichen
Punctelia perreticulata……Reticulate Speckled Shield Lichen
Xanthoria elegans……...Elegant Sunburst Lichen

Threatened
Canoparmelia texana……..Texas Shield Lichen
Dibaeis absoluta……..Pink Dot Lichen

MOSSES

Endangered
Barbula indica var. indica……..Twisted Teeth Moss
Buxbaumia aphylla……..Bug-on-a-stick
Buxbaumia minakatae…….Ethereal Elf Cap Moss
Campylostelium saxicola.……...Rock-loving Swan-necked Moss
Diphyscium cumberlandianum……Cumberland Grain o' Wheat Moss
Lycopodiella margueritae……Northern Prostrate Club-moss
Lycopodiella subappressa……Northern Appressed Club-moss
Lycopodium lagopus……One-coned Club-moss
Philonotis fontana var. caespitosa ……..Tufted Moisture-loving Moss
Pohlia elongata var. elongata …….Narrow-necked Pohl's Moss
Sphagnum bartlettianum……..Bartlett's Peat Moss
Sphagnum riparium……..Shore-growing Peat Moss
Tomentypnum nitens.…….... Fuzzy Hypnum Moss
Weissia sharpii.…….Sharp's Green-cushioned Moss